VAST ARGENTINE CONTRACT.

WASHINGTON, NOV. 13.—Senor Don Vincente Quesada, the new Minister from the Argentine Republic, has just received some information from his Government, the importance of which will be realized by American exporters, and particularly the manufacturers of locomotives, rolling stock and other railway supplies. Several years ago the Argentine Government began the construction of a vast system of internal improvements, embracing railway lines to the various parts of the Republic, running like the spokes of a wheel from Buenos Ayres, the hub, into the interior, and intended to reach not only the interior provinces, but the surrounding nations, Brazil, Chili, Paraguay and Bolivia. In addition to the railway system the harbor of that city was to be improved so as to make it more convenient for vessels to receive and discharge cargo. What is now termed the harbor of Buenos Ayres is no harbor at all, but only an open roadstead in the Rio de la Plata, in which vessels are compelled to anchor eight or nine miles out, and receive and discharge their cargoes by means of launches and lighters and carts.

In order to obviate this difficulty it has long been contemplated to construct an artificial harbor, by extending two long piers from the shore into the river several miles and excavating a basin between them so that the largest ocean vessel can tie up at the docks. The estimated cost of this enterprise is $10,000,000. The city of Montevideo, Uruguay, across the River Platte from Buenos Ayres has suffered from similar inconveniences, and has recently made a concession, running ninety-nine years, to a French company to construct a harbor, which will cost not less than $4,000,000, the company to take payments in fees on goods shipped and landed. Stimulated by the enterprise of her rival across the river, the Argentine Republic has undertaken the construction of a similar harbor. But the railway enterprises of the Government have been such a drain upon the Argentine treasury as to cause serious financial embarrassment. Treasury notes were issued, but immediately fell to a discount of 20 per cent., and it was feared that the credit of the Government abroad would be impaired. The Argentines have always been very proud of the financial standing of their Government, whose bonds have never been below par, but are selling at a premium of 4 and 5 per cent. in the London market, the only South American securities that stand so well. The Government has also feared that an attempt to place another loan of the amount necessary would impair the value of its outstanding securities and was considerably perplexed by the problem it was required to solve.

A happy solution has finally been reached. Senor Quesada has received officical information that the Government has made a contract with Lucius Gonzales, twice Secretary of the Interior, and once Secretary of State, to complete all the railways now in progress, and construct such a harbor as has been proposed. The terms of the contract are exceedingly favorable, and illustrate the public confidence, at home and abroad, in the success of the enterprise and the future prosperity of the Republic. Senor Gonzales, who represents a syndicate of English capitalists, agrees to complete the construction of all improvements now in progress, at their original estimated cost of $59,000,000, of which $10,000,000 are to be expended on the harbor. The Government agrees to issue 6 per cent. fifty year bonds to the amount of $59,000,000, which are to be deposited in London in trust for the syndicate Gonzales represents, until the completion of the entire system of improvements, the time being limited to five years. At the end of this period Gonzales agrees to turn over to the Government the harbor and the railroads, fully completed and equipped, and then if the inspection shall show that the terms of the contract have been complied with, the bonds are to be handed over by the trustees to the contractor. Interest is to be paid, however, on the full amount from the date of the beginning of the work, at the rate of 6 per cent. but is to be withheld by the trustees as a forfeit, until inspection shall show that the amount has been legitimately expended by the contractors. In other words, Gonzales is not to receive his semi-annual interest, amounting to $1,750,000, until it is shown that he has expended an equal amount in construction; and in case of any failure to continue the work this interest is to be considered full compensation for the work performed.

In addition to the construction of a harbor, the Andean Railway, which is to connect Buenos Ayres with Santiago, Chili, is to be completed at an estimated cost of $2,393,000 for construction, $1,000,000 for rolling stock, $600,000 for shops and machinery, $1,000,000 for the expenses of the engineering department; total, $4,993,000. The Central Railroad is to be completed to the coal mines in the southern part of Chili, at a cost of $6,305,000, with $2,000,000 for rolling stock, and $1,000,000 for shops, total, $9,305,000. The Northern road is to be extended to the Bolivian boundary at a cost of $8,000,000, with $1,000,000 for shops, total, $9,000,000. Branches of this line are to be extended from Chumbloa to Catamarca, costing $1,293,000, and from Dean Fuenes to Chilecito, costing $5,000,000. The aggregate expenditure for the Bolivian line is $15,293,000. Another line is to be constructed from Tamatine to connect with the above, costing $2,500,000. The Richahuelo enterprise is to be completed at a cost of $13,931,000, and various other small works at an aggregate cost of $4,500,000, which make a grand total of $49,000,000.

When these works are completed Buenos Ayres will have two lines of transportation to the Pacific Ocean and one to Bolivia, which will make that port the entrepot and shipping point of much of the commerce that now goes from Peru, Chili and Bolivia on steamships through the Straits of Magellan, and the merchants and producers of the Pacific coast, who are now in the same situation regarding the European market that California and Oregon stood in before the completion of our transcontinental lines, will have an opportunity to ship by land as well as sea, the transportation distance being shortened from 4,000 to 6,000 miles and the time of communication shortened from fifteen to twenty days. The coal mines of Southern Chili, where the only steaming fuel to be had in South America is found, will be brought within three days of Buenos Ayres, and the Argentine people will no longer be compelled to import coal from Europe. The producers of Bolivia, who lost their seaports during the recent war with Chili, and are now practically cut off from the markets of the world, will have a means of outlet by the way of Buenos Ayres, and the development of that country will be stimulated to an enormous degree. Bolivia is full of metal, and has vast ranges for feeding cattle and sheep; but the mines have been worthless because of the impossibility of getting machinery into the country, all of the interior transportation being done on the backs of llamas, which cannot carry more than 125 pounds. In addition to furnishing means of communication for the Andes and the Pacific ports with the Atlantic, these roads will make the interior of the Argentine Republic accessible, and that country will have as fine a railroad system as Kansas or Texas. The agricultural lands of the Republic are mostly in the northern provinces, which are now beyond the reach of markets; and the opening of these regions will bring in an enormous immigration from the Old World, while the expenditure of such a vast sum of money will tempt laboring men and mechanics to the Argentine Republic.

The importance of these enterprises to the United States cannot be overestimated. They will not only necessitate the expenditure of many millions of dollars for railway supplies, but the men who will be engaged in the work of construction must be fed and clothed with imported merchandise. The development of the country will increase its purchasing powers, and the expenditure of nearly $60,000,000 of foreign money within five years will give the country such a boom as it has never experienced. As this money is to be raised in England, it may be expected that a large part of it will be expended in that country, but the merchants and manufacturers of the United States can underbid those of England on nearly every article that will be required except steel rails; and if they adopt proper means they will be able to increase their exports to the Argentine Republic to a large amount, and get a fair share of the permanent commerce which this enterprise will develop. *N. Y. Tribune*, 14th.

Utilisation of Slag from the Basic Bessemer Process.

We have on several occasions reproduced notes from German papers showing the great attention which is being given to the phosphate-slag obtained from the basic process in Germany, and such notes continue to appear. A recent article in a paper devoted to agricultural interests, deals with two of the forms in which the phosphate is offered to farmers as manure. One is known as "Thomas slag," or "Thomas phosphate" (the process being universally known in Germany as the "Thomas" process), and consists of the slag as obtained from the converter, simply allowed to weather for some time, and then ground fine. Samples of this, analysed at one of the agricultural laboratories, showed a percentage of phosphoric acid ranging from 17.65 to 19.93, giving an average of 18.75. This is about the same percentage of phosphoric acid as that of a good superphosphate. But then, none of it is soluble in water, and only a small portion of it is soluble in citrate of ammonium, which latter solvent is used as a test as to how much of the phosphoric acid is present in such a condition as to be immediately or rapidly assimilable by the soil. So that in all about ⅗ths of the phosphoric acid is present in a form which can only be very slowly available for the improvement of the land. That such excellent results have been obtained in some special soils as are reported from many quarters, is considered to be due very much to the action of the caustic lime contained in the slags. The land that has been so much benefitted is chiefly moorland, or poor heavy meadow land, with acid reaction. Lime alone would much improve such soils, but it is admitted that the "Thomas slag" has done much more than lime alone would do. This is attributed to the improvement caused by the caustic lime putting the ground into better condition for profiting by the phosphates introduced; and the slag is supposed also to be very much more easily decomposed and dissolved, owing to the acid nature of the soils, than would be the case in other soils in which the same slag has not brought about a marked improvement. Another form of manure from the basic slag is known as "Thomas precipitate." This is prepared by chemical processes from the slag, and contains over 36 per cent. of phosphoric acid. Here again, no part of the acid is soluble in water, but very nearly all of it is soluble in citrate of ammonium, and is therefore looked upon as assimilable by the soil. This is spoken of as a very excellent phosphate manure, giving good results in all soils, when mixed, in the necessary cases, with the requisite amount of nitrogenous manures. We do not recollect having seen or heard anything as to utilisation of the basic slag in England, but it is not probable that the material is being wasted.—*Engineering.*

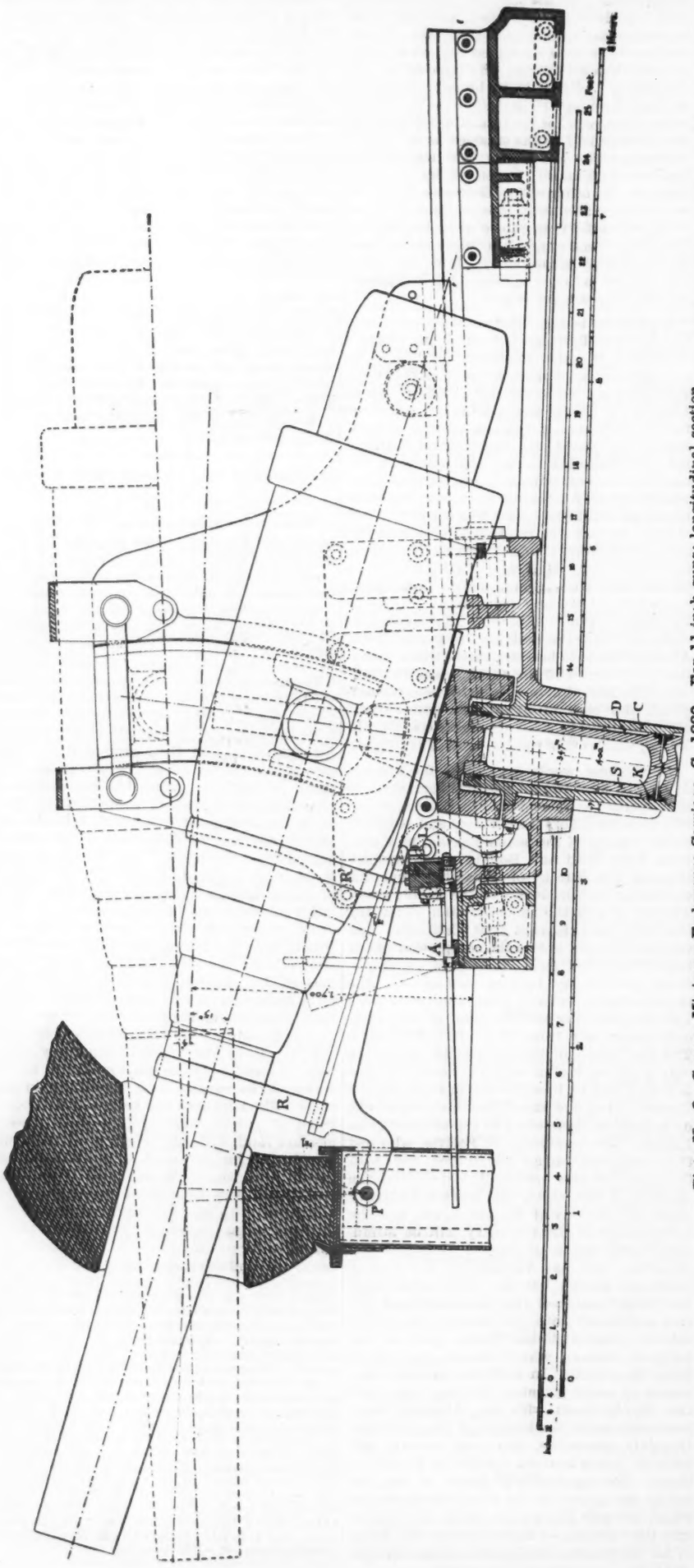

Plate No. 8.—Gruson Minimum-Embrasure Carriage, C—1880. For 11-inch guns; longitudinal section.

NEW ORDNANCE MATERIAL.*

Official Report to the U. S. War Department.

BY WM. H. BIXBY, CAPT. OF ENG'S., U. S. ARMY.

(*Continued from page* 311.)

New Muzzle-pivoting Mechanisms.

For several years there has been a constant endeavor on the part of most artillery officers to reduce the area of the embrasure through which heavy guns are fired, and thus to reduce to the least possible amount the exposure of the gunners. The area of the funnel-shaped opening of ordinary embrasures in an earthern parapet is about 36 square feet; of the Admiralty Pier turret 11.2 square feet; Bellerophon and a large number of British turrets, 10.8 square feet; Gibraltar shield, 9.1 square feet; Gruson's turrets and Colossus turret for 12-inch guns about 4.0 square feet.

Almost all heavy guns of the present day are muzzle-pivoted as regards their movement in traverse; and the general tendency of to-day is to make them muzzle-pivoted also in elevation.

The method usually employed to give muzzle-pivoting in traverse, is to support the carriage and gun on front and rear wheels running on circular horizontal racers whose common center is vertically beneath the center of the embrasure. A similar method to give *muzzle-pivoting in elevation* was submitted by *Col. Shaw*, Royal Artillery, prior to 1870; and consisted in furnishing the gun's trunnion beds with front and rear cog-wheels running in circular cogged vertical racers, attached to the cheeks of the carriage; the common center of these racers being at the muzzle of the gun either at or close to the embrasure, and in a horizontal line through the center of the embrasure and normal to the front of the casemate. By this arrangement the gun had an imaginary pivot at its muzzle; and the solution was so far perfect. The objection to this method was that the whole gun had to be raised or lowered for every change in desired elevation. This raising or lowering was then done by hand power, and cogged-gearing; and was slow and hard work. If done by hydraulic machinery as is to-day used for turret guns, such objection would not be of great importance.

The *Shaw Carriage* was tried at Shoeburyness in 1868 to 1870 with very fair results. The carriage for an 18-ton gun reduced the port to the minimum, viz., 4.5 feet for the 23-ton gun. It weighed 7 tons 11 cwt., exclusive of the platform, which was made of fish-bellied form, 19 inches deep in the middle, 7.4 inches at the end. It cost £1,124 ($5,640).[1]

Perhaps the most complete of these methods is that of *Captain Heathorn*, Royal Artillery. It has at least always been referred to in terms of high praise; it allows the manœuvring of the heaviest guns by hand power alone if necessary.[2]

The *Muzzle-pivoting, Counterpoise Gun-sling of Major King*, U. S. Engineers, actually pivoted at the embrasure by means of a suspended chassis rail, is another perfect muzzle-pivoted mechanism.[3]

The *Muzzle-pivoting Non-recoiling Gun-casemate Gun of Mr. Krupp*, actually pivoted both at its muzzle and its embrasure by means of a ball-and-socket-joint at the chase of the gun, is another perfect muzzle-pivoted mechanism. It has been already described in full.

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[1] See Report of Special Committee on muzzle-pivoting carriages, Part 1, Land service, War office, London, 1870; also, Shaw, Muzzle-pivoting guns; pages 346 to 353 (2 plates), Vol. 9, Journal R. U. S. I., for 1865.

[2] For full details; see Heathorn, Muzzle-pivoting gun-carriages, pages 169 to 180 (1 plate), Vol. 12, Journal R. U. S. I., for 1868; also, page 336 (2 figures), Vol. 9, Journal R.U.S.I., for 1865.

[3] It is fully described in pages 35 to 38 (3 plates) of U S. Ordnance Notes, No. 16.

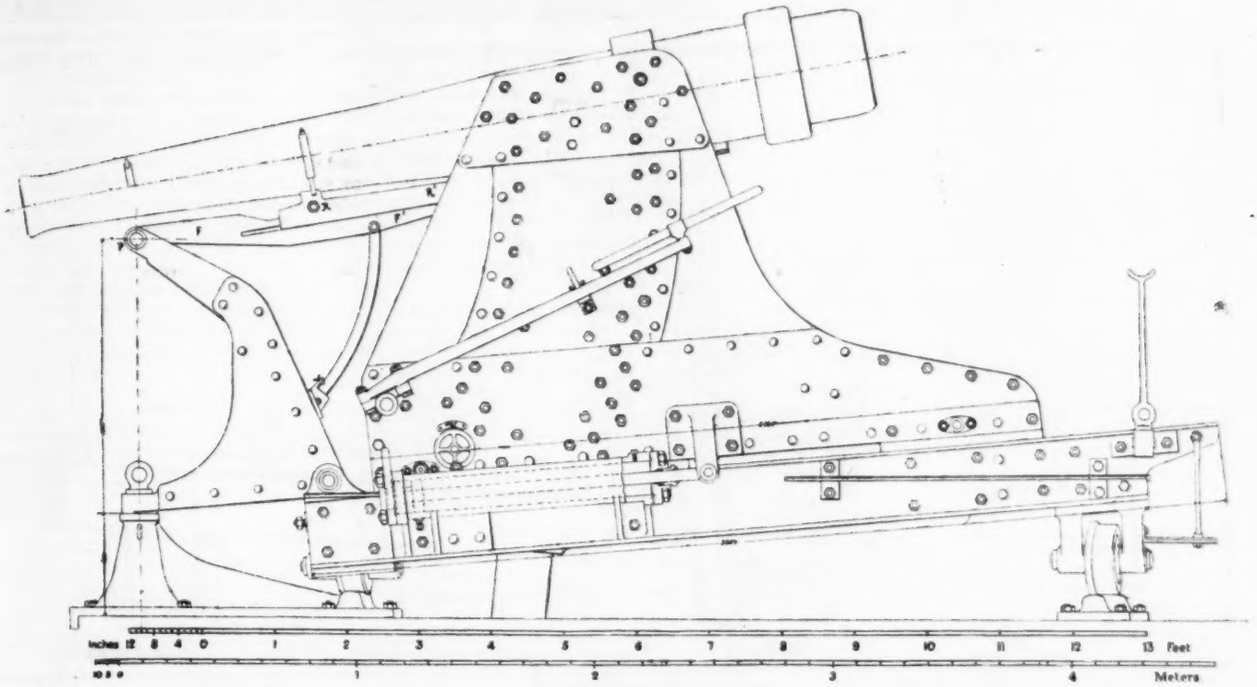


Plate No. 7.—Gruson Minimum-Embrasure Carriage, C—1880. For 6-inch Gun, side elevation.

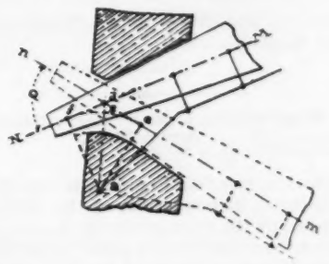
In each of these cases the muzzle-pivoting in itself is perfect; but the first two methods are the only ones adaptable to the ordinary forms of chassis and upper-carriage mountings.

Other easier-constructed mountings have been since proposed to give approximately the same results.

The *Gruson Old Model* (prior to 1880) *of Minimum-embrasure Carriage*, was in general principles similar to that of Col. Shaw; the main difference being that the circular vertical cogged-racers were replaced by a 3-link mechanism. In this carriage the first link was fastened loosely at one end to the gun's trunnion-beds, and firmly at the other end to a fixed pivot on the carriage cheeks; the third link was fastened in like manner to the fore part of the gun half way between the trunnions and muzzle; the second link connected the first to the third. The gun was then lifted bodily by a hydraulic press under its trunnion-beds, and the latter slid in circular grooves whose center was at the gun's muzzle; the positions and lengths of the 3-links were so adjusted that the free ends of the first and third links described nearly concentric circles about the muzzle of the gun, and the muzzle of the gun remained nearly stationary. (See Plate No. 9). As this model is now given up, further description is here omitted.

Mr. Gruson has also proposed the use of a fixed support called "*embrasure-ring*" attached to the front end of the upper carriage and embracing the chase of the gun. In this case, the main weight of the gun is lifted as before by a hydraulic press under its trunnions; the gun has however a slight front preponderance which keeps the gun's muzzle always pressed down upon the embrasure-ring support. This method has never actually been put to use.[4]

The most successful mountings are those of Armstrong as applied to the Colossus and other recent British ship-turrets, and those of Gruson's new model (C-1880) as applied to almost all the recent continental land turrets. The muzzle pivoting principle is the same in each, although the carriages are in themselves quite different; both reduce the embrazure to about 4 square feet for the 12-inch gun. Instead of making the gun pivot vertically about an imaginary point at the muzzle of the gun or at the embrasure, the gun's axis is forced to remain tangent to an imaginary circular arc whose plane is vertical and whose center is as nearly as possible directly beneath the center of the embrasure.



Suppose M N and n to be the extreme positions of the gun's axis at extreme depression and extreme elevation; d their intersection; a the center of the arc $f s e$, to which the gun's axis is forced to be tangent; f and e the points of tangency; and s the intersection of the radius da with the arc fe. Suppose a to be vertically under d; and denote the angle $M d m = N d n = f a e$ by Q. Then ds will mark the total rise and fall of the guns axis in the vertical line through a, which is also the position of the embrasure throat.

This distance ds will be found equal to

$$a e \times (\sec \frac{Q}{2} - 1)$$

a very small quantity comparatively speaking. If $ae = 4.5$ feet, and $Q = 36$ degrees, both being large estimates for the largest guns of to-day, ds will be found equal only to about 3-inches. Allowing ae to be 6 feet in order to allow for the radius of the guns chase, ds will only equal 4-inches. The embrasure need then be no wider and only 4-inches higher than the gun's muzzle. It is however customary to add 2-inches play all around the muzzle of the gun, making the embrasure about 4-inches wider and 8-inches higher than the actual section of the gun at the embrasure.

Armstrong Minimum Embrasure Carriage (Model of 1880.

In order to force the gun's axis to remain always tangent to the vertical arc described about "a" as a pivot, Armstrong uses the point "a" as a front pivot for his chassis rails; the gun being strapped to a bed which merely slides along the chassis rails; in other words, Armstrong takes the trunnions off of the gun, puts them on the front end of the chassis, and places these trunnions as nearly as possible under the embrasure. Were such a method applied to ordinary casemate guns, the point "a" would have to be the intersection of the axis of the vertical front-pintle and horizontal front trunnions of the chassis or slides.

Such an arrangement requires the whole gun, its gun-bed and its chassis to be lifted together bodily whenever it is desired to change the elevation of the gun. It is needless to say that such lifting is usually done by hydraulic power. This method of mounting is in actual use in the Italia, Lepanto, Colossus, Edinboro, and Conqueror turrets, and in the Collingwood barbettes.

Such a muzzle-pivoting mechanism demands of course the use of a special form of carriage.[5]

Gruson Minimum-embrasure Carriage.—Fig's. 7. 8.

In order to obtain similar results by a method applicable to the ordinary forms of carriage, Gruson in his new model of minimum-embrasure movable-trunnion-bed muzzle-pivoting-gun carriage (C-1880) uses the point "a" merely as the fixed pivot of a guide-bar whose rear end slides freely through two holes or slots, one in each of two collars fastened to the chase of the gun at points about 4 feet apart. The gun is otherwise of the ordinary form, and has trunnion pivots with a zero preponderance; the gun can be raised bodily while resting in its trunnion beds by means of a hydraulic press between the trunnion-beds and the upper-carriage.

The two above-mentioned holes or slots in the gun's collars, are at equal distances from the axis of the gun's bore; the gun's bore must therefore always remain parallel to the pivoting-bar; the pivoting-bar turns downward at its front, and is fastened at its front

[4] It is shown quite fully in plates 3, 4, 5, of "Eisen Panzer Constructionen", of the Austrian "Constructions Details."

[5] See pages 42 to 45, Senate Document No. 969 of Feb. 9th, 1883, 2nd Session, 47th Congress, quoting from the London Times a very interesting description of this form of mounting, and its automatic loading machinery as used on the Italia, Lepanto, Colossus, Conqueror, Edinboro, Majestic and Collingwood.

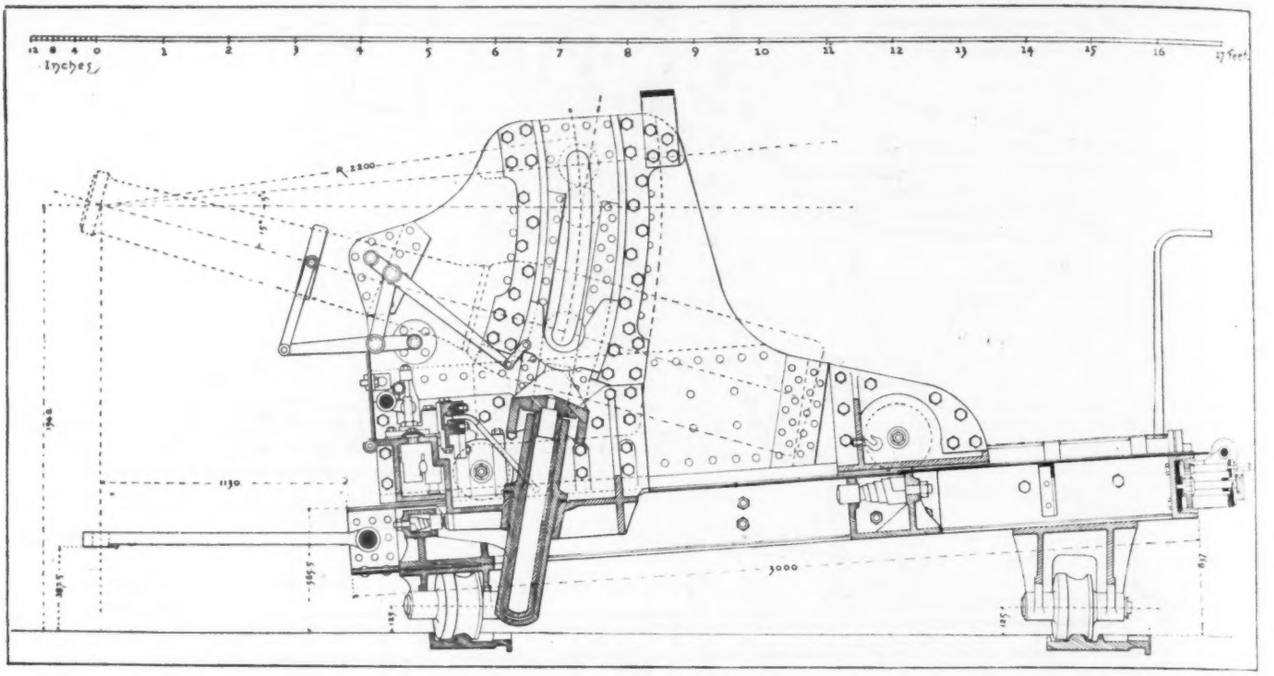


Plate No. 9.—Gruson Minimum-Embrasure Carriage; old model. For 6-inch guns; longitudinal section.

and to the point "*a*;" the point "*a*" therefore remains at a constant distance from the prolongation of the straight portion of the pivoting bar, and therefore at a greater but also constant distance from the prolongation of the axis of the gun's bore. When the gun's elevation is to be changed, the trunnion-beds are raised or lowered and at the same time the gun turns slightly on its trunnions so as to remain parallel to the pivoting-bar. When the gun recoils and rolls backward up its platform, the gun turns slightly in a similar way as the collars slide along the pivoting bar. The strain upon the pivoting-bar is very slight; the gun remains clear of the embrasure cheeks during its recoil; and the whole pivoting movement is quietly but effectually produced. This method of mounting is in actual use for all the Gruson German turrets constructed since 1880. In order to prevent any unnecessary forward-and-back motion of the gun while being elevated, its trunnion-beds are made to move in circular grooves whose center is at "d" in the throat of the embrasure.

The arrangement of this mechanism applied to the 6 inch gun, is fully shown in plate No. 7, applied to the 11-inch gun it is shown in plate No. 8.[6]

These carriages vary in price from about $3,000 for 5-inch guns up to about $10,000 for 12-inch guns.

Other features of this carriage, the special arrangement of the carriage rollers, its hydraulic arrangements, and the actual size of the embrasures are shown in the drawing.

Such a muzzle-pivoting mechanism can be readily used in connection with any of the ordinary forms of gun carriages.

Minimum-embrasure carriages were adopted by the Prussian government in 1872; and since 1875 all small carriages have been of the new Gruson (C-1880) model.

Many other so-called muzzle-pivoting carriages do not rightfully come under this heading. The most of them are variations of the well-known compound-trunnion-and-muzzle or partial-muzzle-pivoting carriages, such as those of Capt. Scott, R. N., or Col. Inglis, R. E., where an ordinary trunnion-pivoted gun can receive about five degrees motion in each of several positions to which it may be raised on its movable trunnion-beds. Such mechanisms are no longer new and were not particularly studied by the writer. They may be studied in the descriptions and articles already referred to, and in those quoted below under the head of manoeuvre of heavy guns (especially in the writings of Claverino, Rendel, Cunningham, Scott, Mackie, Dawson and Butter).

TO BE CONTINUED.

[6]The above description and drawings are nearly the same, as submitted by the writer to the U. S. Eng. Dept. in 1881.

What it Costs to Make Heavy Guns and Armor Plate.

The Congressional committee appointed to investigate and report upon the policy to be adopted by the Government to secure a supply of ordnance and armor plate began a session in the New York Hotel on Tuesday. A number of men interested in iron and steel manufacture had previously been invited by circular to meet the committee and express their views on the subject under consideration. The Hon. Abram S. Hewitt presided, and the other members of the committee present were Congressmen Frank Hiscock, Thomas B. Reed, Charles F. Crisp, and William Walter Phelps. Mr. Hewitt explained that the committee desired to ascertain how much patronage from the Government was necessary to induce steel manufacturers to go into the business of making heavy guns and armor plates.

Benjamin Ather, of B. Ather & Co., whose foundry is at Newark, N. J., told the committee that the Government would probably have to give a contract calling for the supplying of from 6,000 to 8,000 tons of steel a year for five years in order to make it worth while for an American manufacturer to establish a plant suitable for the production of armor plate. Mr. Hiscock asked what Mr. Ather would consider a fair price for the Government to pay for such plates. Mr. Ather had not made any close estimates, but he thought that $500 a ton, or about 25 cents a pound, would be about right.

William Bispham, an iron merchant of this city, said that there was not a steel plant in this country large enough for the production of armor plate of the weight, thickness, and resistance necessary for the construction of modern fortifications and war vessels. The cost of establishing such a plant would be from $2,500,000 to $3,000,000. Armor plate could be made more cheaply abroad than here. The present time would be favorable for the United States Government to make a low-priced contract with Sheffield manufacturers for a supply of armor plate, because business was dull. Mr. Bispham was in favor of encouraging American manufactures, but it would take a long time to establish first-class armor factories in this country, and he thought that the Government ought not to lose an hour in strengthening the navy and seacoast fortifications.

Charles J. Nourse, a representative of the West Point Foundry, said he thought that a complete plant for the manufacture of good-sized guns could be established in this country if the Government would give a five years' contract for $1,000,000 worth of guns each year. Those figures were for guns not larger than 12-inch bore. For guns of a larger size the contracts would have to be proportionately greater. Mr. R. W. Davenport, Superintendent of the Midvale Foundry, near Philadelphia, said that his concern was now at work on an 8-inch gun, for which 40 cents a pound was to be paid. He could not tell how much he would charge for making a 10-inch or a 16-inch gun. He remarked that a 16-inch gun was "so far up in the clouds," that he had never figured on its cost.

"It may be 'up in the clouds' for you," said Mr. Hewitt, "but it is an accomplished reality elsewhere. I have seen it with my own eyes."

Mr. Davenport said that the Midvale Foundry would require an order from the Government for 3,000 tons of steel in order to induce it to attempt to make a 10-inch gun, and an order for 5,000 tons of steel to make a 12-inch gun. Mr. Davenport invited the commission to visit the Midvale Foundry, and Chairman Hewett intimated that the commission would accept the invitation about Friday.

Joseph Morgan, Jr., of the Cambria Iron Works, thought that an order from the Government for 10,000 tons of steel manufactured into guns and delivered over a period of five years would be sufficient inducement for the establishment of works for the manufacture of large guns. That would necessitate an outlay

by the Government of about $10,000,000, or $2,000,000 a year for five years. The Cambria Works had three large open-hearth furnaces capable of casting an ingot large enough to make a 100-ton gun. Mr. Morgan said that his concern would not undertake to contract to furnish large guns completed at present. There were rolling mills in this country, Mr. Morgan said, capable of rolling armor plate of from 9 to 12 inches in thickness. The speaker believed, however, that the best of armor plates would soon be produced by presses and not by rolling.

The committee will continue their session to-day. The Hon. Samuel J. Randall, Chairman of the committee, is expected to be present. To-morrow the committee will go to Sandy Hook.—*N. Y. Times.*

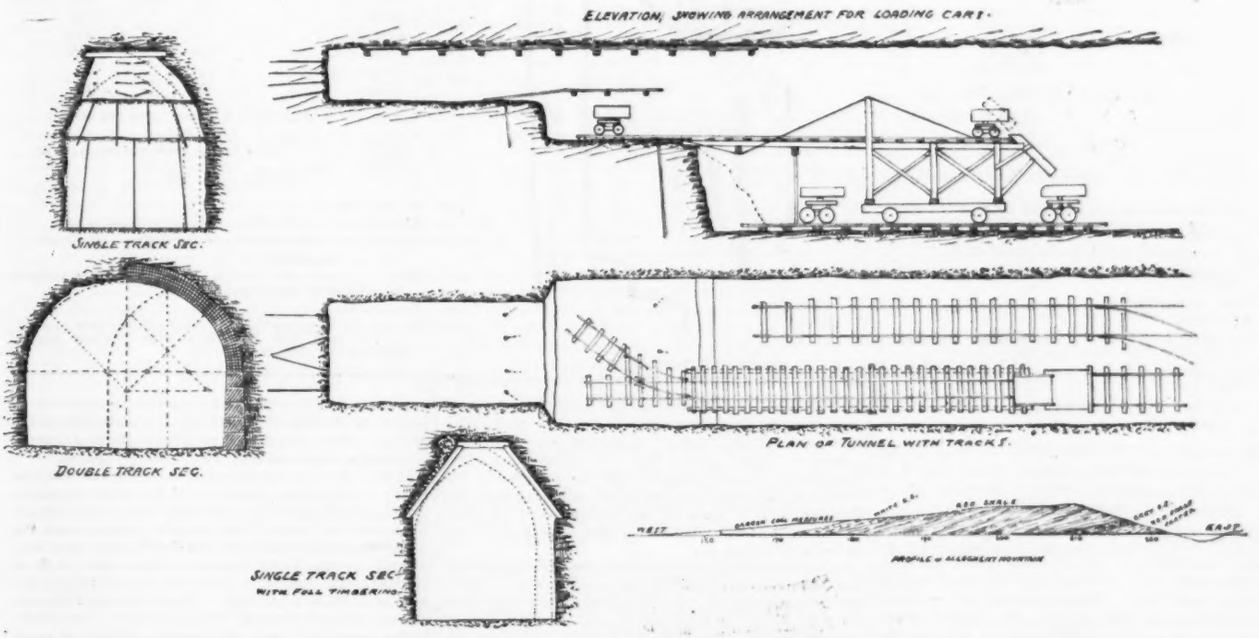
ENGINEERING NEWS three months, One Dollar and Fifty cents.

Magnetic Survey of Scotland.

Professors Thorpe and Rucker have, during the past two years, been engaged on a magnetic survey of Scotland. Their observations were made at fifty stations distributed throughout the country, and chosen partly with a view of repeating the measurements made by Mr. Welsh, of the Kew Observatory, in 1857-8, and partly of avoiding, as far as might be, regions of great local disturbance. They employed magnetometers and dip circles of the most approved modern type, and specially made for the survey. These were compared with the standard instruments at Kew, which thereby becomes the base station of the survey. In the determinations of solar azimuths in the observations for declination, they were enabled to compare their chronometers with time signals sent from the Greenwich Observatory daily at 10 A. M. and 1 P. M. o'clock over the Postal Telegraph wires. The special observations were also made in the Island of Mull, which from its geological nature, exercises very powerful disturbing effects on the magnetic needle. The results of the survey show that such disturbing areas may be approached within certain distances without the compass being affected. While upon this subject, we may mention that Herr J. Liznar has communicated a paper to the Austrian Meteorological Society, in which he shows from a great variety of observations, that the moon exerts an influence on the declination needle, which varies with the distance of that body from the earth, with its phases, and positions in reference to the earth's equator. Herr Liznar finds that the magnetic perturbations are greater when the moon is nearer the earth, and greater when it is full moon than in the first and second quarters. The perturbations are also a maximum when the moon is in the plane of the equator, and larger when her declination is austral than when it is boreal.

No. 4.—ALLEGHENY MOUNTAIN TUNNEL.

Continued from page 308.


ELEVATION, SHOWING ARRANGEMENT FOR LOADING CARS.
SINGLE TRACK SEC.
DOUBLE TRACK SEC.
PLAN OF TUNNEL WITH TRACKS.
SINGLE TRACK SEC WITH FULL TIMBERING
PROFILE OF ALLEGHENY MOUNTAIN

1. **Allegheny Mt. Tunnel, East and West.**
2. Red shale, both sides.
3. Dipping about 10° West.
4. See sketch, 7 feet × 12 feet. 2.75 cubic yards.
5. Four holes. See sketch. 6 feet apart on face for 7 feet cut, 10 feet deep.
   4 feet " " " 5 feet " 8 feet "
6. 75 pounds 40% dynamite per cut; perhaps once in four times the holes have to be loaded and fired a second time, and once in twenty times a third charge is required.
7. 5.0 feet.
8. 14 hours. (*a*) 10 hours. (*b*) 1 hour. (*c*) 3 hours. Muck cleared out by wheelbarrows.
9. 3 to 4 each side. See sketch; from 2 feet to 3 feet from cutholes, lowest hole 10 inches outside of line of others 7 feet deep.

9½. Yes. And enlargement preparation for timber as done by another force.

10. 20 pounds included in answer 6 above.

11. 15 pounds heading.
    2 " sides.
    8 " bench.
    5 " bottom.

    30 pounds per lineal foot.

12. Force employed per lineal foot of tunnel, assuming average 40 feet a week for 12 shifts.

	HEADING.		BENCH.		BOTTOM.
Foremen	0.30	Days.			0.30
Runners	1.20	"	0.30		0.30
Helpers	1.20	"	0.30		0.30
Muckers	2.40	"	1.80	Laborers	3.00
Nipper	0.30	"	Miners 1.20	Nipper	0.30
Boy	0.30	"	Cars 0.60	Snapper	0.30
				Mule and Driver	0.30
				Locomotive	0.30

13. Columns, 5 feet from face, two machines on columns.
14. In two benches, as in sketch, upper bench has track and two cars which are run over bottom men on carriage, and dump into cars below.
15. Heading, 2.75 cubic yards. Bench, 3.3 cubic yards. Bottom, 8 cubic yards per lineal foot. 40 feet per week. 5 feet per cut. 3 12-feet holes. 7 cartridges or 5 pounds to a hole. Additional lifting holes 10 pounds. Total 25 pounds per cut or 5 pounds per foot.
16. Hitches are cut in sides, caps slid into these; in bad ground posts are added.
17. Treacherous roof.

Power, compressed air. Plant as below.

Boilers: One 50 H. P. Two 25 H. P. Two 20 H. P. Total, 140 H. P.

One 20 inch × 30 inch Ingersoll air compressor; new; run at 75 @ 90 revolutions, ¾ cut off.

One 16 inch × 20 inch Ingersoll air compressor; new; run at 90 revolutions, ¾ cut off.

Two 12 inch × 15 inch Burleigh air compressor; old; run at 100 revolutions, no cut off.

Pressure in compressor house, 70 pounds.
" " tunnel was 50 "
" " " is 60 " since length of conducting pipes was reduced, see below.

Have run 16 drills in double-track, and two air derricks; now run 12 @ 13 drills, one derrick, and 8 H. P. pump. There are two 25 H. P. locomotives.

Compressor house is located 2,000 feet south of line, at a point 1,700 feet east of West Portal; 2,000 feet 3½ inch pipe, 9,000 feet 3 inch pipe; pipe carried over mountain until air-holes 1,669 feet from east end, and 1,250 feet from west end, were drilled; since then pipe goes down these holes 10 inches diameter.

Electric lights tried and abandoned; gasoline lamps now used.

No artificial ventilation; air generally good.

1,250 feet double track to be arched, 3,400 feet permanent timbering.

Material from west end wasted at average haul of 1,200 feet from portal; at east end all material carried into main bank; average haul 600 feet from portal. East heading begun February 18th, 1884.
West " " April 21st, "

Contractors, CHARLES MCFADDEN & SON.
Engineer in charge, CHARLES E. WEBSTER.

QUEMAHONING TUNNEL.

1. Quemahoning, West.

2. Soft gray slate—requiring timber support.
3. Horizontal.
4. 8 feet high, 14 feet wide at bottom, with top 1½ feet below gothic point of arch.
5. (See sketch No. 3). From three to four holes *A A A* are first drilled 2½ to 4 feet, with inclination of about 45°,—after blasting these, holes *B B B* are drilled with inclination of about 25°; and lastly holes *C C* are driven nearly horizontal.
6. 33 pounds ⅝ giant powder, exclusive of trimming up sides and gothic top.
7. About 3 feet.
8. Ten hours and twenty minutes,—*A* = 8 hours, *B* = 1 hour 10 minutes, *C* = 1 hour 10 minutes;—each drill is tasked 20 feet per shift.
9. Generally five holes each 6 feet deep—one of these in the gothic top, and the others parallel with sides; or sloping outwards and downwards according to circumstances.
9½. Not at same time, but generally in same shift, after blasting cut
10. Rounds 6 pounds ⅝ giant powder.
Gothic 1½ pounds black powder.
11. Advance heading 11 pounds 40% giant powder.

Rounds	2	"	40% " "
Gothic	¼	"	black powder.
Bottom	11	"	40% giant powder.

12. Force per lineal foot of tunnel.

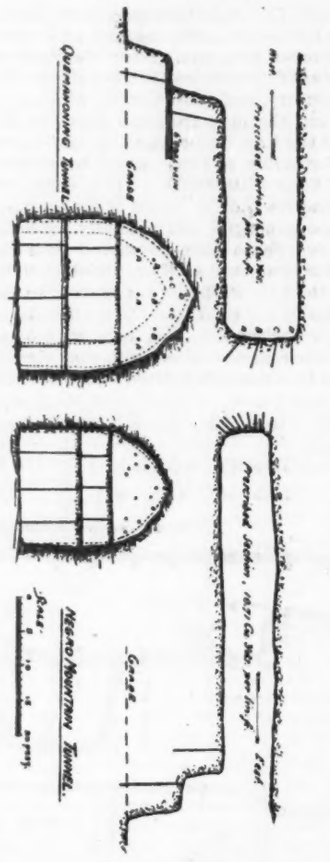
HEADING.		BOTTOM.	
Foremen	0.27	Foremen	0.25
Drillers	0.80	Drillers	0.94
Strikers	0.80	Strikers	0.94
Muckers	0.80	Muckers	2.25

Force (per 10 hour shift) not included above.

Blacksmith	1	Powderman	1
Dumpsmen	2	Drivers	2
Horses	1		

13. No Machines used.
14. In two lifts, each worked with three holes across the bench.
The center holes are inclined 70° and the side holes vertical or leaning slightly towards the sides of tunnel.
The average cut is 4 feet (see sketch No. 4).
15. Yardage of bench (timber section) 10 cubic yards per foot run.
Time 2½ hours.
16. None used.
17. To prevent haunches of arch being loosened when blasting out the the gothic top.

5TH. DIVISION.



To be Continued.

NEGRO MOUNTAIN TUNNEL.

1. Negro Mountain, East.

2. Hard gray slate.
3. Horizontal.
4. (See sketch No. 2). Yardage, 3 cubic yards per lineal foot.
5 to 10. As the tunnel is worked by hand, no regular system is constantly used. Generally three or six holes are drilled near the bottom of heading about two to three feet deep (see sketch No. 1) and loaded with about 1 pound of 40% dynamite.
After these holes are fired, the remaining holes are placed according to the position of the rock, which is very irregular, and fired three or six at a time.
The cut, if such it may be called, will take out about 1½ lineal foot of heading: working three drills (six men) in the heading, and have the men at "task work," each drill putting down 14 feet per shift.
Consequently they fire about six times during a shift.
The side trimming, when required, is done bp a separate force of men.
11. Heading, including side trimming, 14 pounds 40% dynamite per lineal foot.
Bench, 14 pounds 40% dynamite per lineal foot.
Total, 28 pounds 40% dynamite per lineal foot.
12. Force per lineal foot of tunnel:

	HEADING.		BENCH	
Foremen	0.50	Days.	0.22	Days.
Drillers	1.50	"	1.00	"
Strikers	1.50	"	1.00	"
Muckers	1.00	"	3.00	"
Trimmers	0.05	"		
Nippers	0.50	"	0.22	"

Force (per 10 hour shift) not accounted for above.

Superintendent	1.00	Blacksmith	1.00
Helper	1.00	Dumpsman	1.00
Powder-man	1.00	Horses	1.50
		Drivers	1.50

13. None used.
14. (See sketch No. 1). Material loaded from grade.
15. Yardage, 8.0 cubic yards per lineal foot. Holes 10 to 14 feet per lineal foot.
Time, 2¼ hours per lineal foot. Explosives 14 pounds 40% dynamite per lineal foot.
16. None used.
17. To get the heading to conform to the gothic section, as the rock lies horizontal with vertical seams, causing the sides to scale off.

LITERATURE.

THE PANAMA CANAL.—*Its History, its Political Aspects and Financial Difficulties.* By J. C. RODRIGUES, L. L. B., New York. Charles Scribner's Sons, 1885. 7⅝" × 5". pp. viii & 248. $1.50. *No Index.*

Engineers who have taken interest in the great work of Count Ferdinand de Lesseps at Panama have known for some time that the estimates on which the work was commenced were so inadequate that the capital already invested would probably be lost; that however much attention had been given to the studies of the great dam and reservoir at Gamboa, they were still incohoate and that important problem was as yet without satisfactory solution; that the great cut at Culebra with a center depth of 361 feet is not, as is desirable, granite or even stratified rock, but a large part of it is very like hardpan, and as the center line is on a side hill, the heavy rains and consequent saturation of the ground may give a slope as flat as 1½ on 1, which would extend it to a height of 993 feet, thus increasing enormously the quantity of material to be moved and adding decidedly to the time requisite for the completion of the work.

All feared that the banks of the two parallel rivers that were to keep the water of the country out of the canal, even though one was designed to carry 7,000 cubic feet per second, might fail in some place, bringing deposits of earth, trees and rock into the canal. And those of us who have had experience in digging a working train out of a slumped-in cut, thought of a slope nearly 1,000 feet high, under a rain of 4 or 5 inches in as many hours, and speculated as to the number of years following the opening of the canal before steamers could use that channel with any certainty in regard to time tables, connections and other arrangements, about which travellers and shippers are apt to be so unreasonable.

We also knew that de Lesseps had said before the American Society of Civil Engineers that he was not an Engineer but a *Diplomate*, and were told that at Washington he had denied the diplomacy, claiming to be simply an engineer; we concluded that he had told the truth to truth loving men and was a diplomat to some considerable extent; so when news was received that a series of able articles on the administration of the Panama Canal was appearing in the London *Financial News* which would be reprinted here and elsewhere, we hoped for reliable data on so important a question. The book however, on account of the partisan spirit in which it is written, is a disappointment.

Dr. Rodrigues tells us in his preface that he was sent down to the Isthmus by the editor of the New York *World*; he apparently also had a collateral engagement from the New York *Nation*, to which he says he contributed some editorial matter on the subject.

Both of these papers had committed themselves against the Panama project, and an editorial in the *Nation* of July 31st, 1879, made assertions against the Panama and in favor of the Nicaragua Canal, supported by the same citations of authority that we find in the book before us.

On the steamer the author was outspoken in his condemnation of the scheme he was sent down "to write my impressions on" "in its different bearings," and when he wrote "In studying the way in which that enterprise was launched I was led into a most mortifying disappointment", it looks as if he should in truthful illness have stated that his mortification commenced before reaching the Isthmus.

Throughout the book every endorsement of the Nicaragua and any statement or estimate against the Panama route is reverently received.

The proposal of Commander Lull to build an aqueduct for the canal, 1,900 feet long, and ten miles of feeder, with seven tunnels of 15,700 feet aggregate length, to serve a canal 123.75 ft. above the sea, when the railroad crosses the Chagres at Barbacoa, on a bridge 625 feet long and 71.5 feet above tide, is solemnly given as weighty matter against any canal by Panama. Of the commission appointed by General Grant, that found for the Nicaragua route, he says, "such was the judgment of competent men, specially fitted to form an intelligent opinion on the subject", ignoring the fact that only one member of the commission had been connected with the design, execution, or maintenance of works.

Sailors tell of the application of a saw-mill man for employment as able bodied seaman, with resentment, although he showed his familiarity with water, and landsmen generally see the point of the objection, but very intelligent people are ready to trust to the engineering judgment of—for instance, "a voracious absorber of technical knowledge," who has never seen a yard of earth moved, a stone laid, nor has had an opportunity to see the change made in the face of a country by a well or ill located improvement.

A stupid sneer at Mr. Menocal, probably by some super-serviceable underling, calls for the following serious consideration.

"The Lesseps party * * * referred to M. Menocal the celebrated explorer of Nicaragua and Panama, as 'un jeune ingénieur Americain qui affirme avoir fait des études * * * Il est permis de croire * * qui'l réussirait a faire un escalier en spirale, mais jamais un canal.' This reference to the United States engineer, whose work on the Isthmus Wyse had declared to be indispensable to all who have any studies to make on it, and whose Nicaragua project was the nightmare of the Lesseps party, illustrates to what a pitch of infamy triumph in a bad and desperate cause is capable."

Those who are suspected of favoring the Panama route on the other hand receive but scant courtesy. Lieutenant Rodgers, whom he calls "this extraordinary lieutenant," is blamed that he gives in his report the quantities he received from the French, and also "it is remarkable that Lieut. Rodgers did not deem it fit to give the actual number of cubic metres that had been excavated up to January, 1884." Was it thought that even charge of the Bureau of Naval Intelligence at Washington would fit a man to judge of millions of yards of excavation, or did our author suppose that United States ships carried several well-trained cross-section parties? With Truthful James I do not approve of "putting a head on a scientific gent" and must deprecate "we do not attach the least weight to any opinions of Lieutenant Rodgers who thus showed himself so incompetent to use his own head and eyes on the Isthmus of Panama," just because he thought "that the question whether this is or is not a better route than that of Nicaragua, has almost passed from the problem of interoceanic communication." It may, however, be held remarkable that a United States Naval officer should endorse the longest route for the commerce of his country, and one where the "Doldrums" will prevent the use of the 17,000 sail-vessels we own.

But it is de Lesseps' technical commission whose labors he (already mortified) went down to report, that draws out his adverse criticism. "They looked very much more like a 'pic-nic party' than like a scientific committee. The writer of these lines was with them for twelve days out of the thirty in which they intended to accomplish the verification of a survey that had never been made (he shows later, they devoted forty-five days to it), and he can say that there was not a stroke of earnest work done in those days."

"Colonel Totten, now old and broken down, was also made a committee-man. He was an *employé* of the Panama Railroad directors, who were anxious to sell the road to the Frenchmen." Though Col. Totten built the Panama Railroad, he had not been in its employ for several years, and went to Panama on de Lesseps' invitation. He was known to have been an advocate of a canal at Panama, having made estimates for both a sea-level canal with tunnel, and a canal with locks; his long residence on the Isthmus and general ability as an engineer, rendered his advice more valuable than that of any other man, and he was so 'old and broken down' that he left Aspinwall to examine the La Guaira & Caracas Railroad. "Col. Totten is the same gentleman who never believed in a canal through Panama, and

had so reported to Kelley, as we have stated in the first chapter." In the N. Y. *World*, of January 6th, 1880, is a dispatch dated Panama, January 5th, 1880, which reads, in part, "Col. Totten, the American engineer who endorsed the project of M. de Lesseps at the Paris Congress last year."

"A young man, a son of M. Couvreux, wholly inexperienced; M. Dauzats, ex-chief of service in the Suez Canal, of whose unfitness we shall have occasion to speak hereafter: M. Blanchet, a very conscientious fellow, but in the employ of M. Couvreux, and finally two-fifth-rate Colombian engineers—two soft-handed, bland gentlemen—who always dressed with extreme neatness."

"The commission was employed to say that the Chagres was 'all right.'"

"The commission was a humbug. It was pledged beforehand to M. de Lesseps."

It will be hard to convince those who have known of Col. Trotten for years and met Dirks and the other members of the technical commission that the last two statements were not drawn from the internal consciousness and personal experience of Dr. Rodrigues.

The estimate of the technical commission $13,000,000 francs *without* preliminary, banking or administrative expenses or interest during construction, *i. e.*, the bare cost of the work as shown by the estimates to the contractors, was undoubtedly too small; they raised the estimated amount of excavation from 46 to 75 millions cubic meters, 63 per cent. not as our author states "almost doubling the quantity," and the cost of the dam at Gamboa, and the rectification of the Chagres from 42 to 175 million francs, but still the prices were too low.

It was known to nearly everybody on the Isthmus that Mr. Blanchet referred to by the author as in the employ of the contracting firm of Couvreux & Hersent having preceded de Lesseps and his party had been engaged in sinking test pits, etc. some of which the commission visited, to determine the probable cost of the work, and M. Couvreux offered to do the work at the prices fixed; this was well known and widely commented on shortly after the party reached New York; and the author's failure to mention it seems a suppression of a truth vital to a fair statement of the case.

Col. Totten in a letter written to John C. Campbell C.E., from Panama, before leaving for La Guaira, says "The prices fixed by the Paris Congress, were adopted by the commission * * * as MM. Blanchet & Couvreux, who represent large contracting parties in France, those who built a large part of the Suez Canal, stand ready to contract for this work at these prices, I could not well advocate higher ones, although my judgment would lead me to do so."

Our readers can judge how far engineers are justified in estimating the cost of work higher than responsible contractors offer to bid at without competition.

There is, relative to the Tehuantepec route a serious mis-statement of facts, viz: "The United States Government soon after sent Gen. Barnard of the corps of engineers to survey the Isthmus of Tehuantepec, also with a view to building a railway. Barnard found the route impracticable." Now, in 1871, Gen. J. G. Barnard, with Julius W. Adams, and J. J. Williams, signed a report to Simon Stevens, President of the Tehuantepec Railroad Company "On the Artificial Water-ways of Europe with special reference to the Tehauntepec Railway and Ship Canal," a report which was printed and widely circulated, and which among other things contains the following: "At which time, the company having applied to President Taylor for an officer of engineers to direct the survey, Brevet-Major J. G. Barnard, Captain of Engineers, was detailed for that purpose." After explaining why the survey was made for a railroad instead of a canal, and why a higher summit was adopted than had been proposed for the canal, adds of the survey: "We need only state that it established the practicability of a railroad route at moderate expense, and with grades not exceeding 60 feet per mile."

And further, "We allude to the survey made during the last winter and spring by Capt. R. W. Shufeldt, of the United States Navy. We learn in the preliminary report (furnished by direction of Secretary of Navy) from the highest source and in the most positive form the important conclusion, 'that an interoceanic canal of any necessary dimensions may be constructed across the Isthmus of Tehuantepec.' We have also the further statement of the engineer on whose exploration Captain Shufeldt bases his own dictum (just quoted), 'that a ship-canal across the Isthmus of Tehuantepec is not only practicable, but also that the topography of the country presents no extraordinary obstacles to its construction.' The latter statement that, 'the topography of the country presents no extraordinary obstacles to the construction of a canal' is but a confirmation of the information obtained from Major Barnard's, M. Sidell's and Senor Moro's surveys."

The report of General Barnard's original survey was published by Appleton in this city, in 1852, and though the interest in the route has made it a difficult book to buy, it is in many libraries and often quoted. Captain Shufeldt's report was published by the Government in 1872, and is a standard work.

The four lines quoted above from Dr. Rodrigues, which cover two mis-statements, contain the only reference to the Tehuantepec route noticed in the book. For the assertion "Barnard found the route impracticable," only one explanation seems possible, and that unfortunately is not in harmony with his introductory hope "to be able to leave upon the mind of the reader a truthful idea of the whole range of that question in its many sided phases." A failure to give any further notice of a route that presents a saving of 1,857 miles for New Orleans and San Francisco, and 1,173 for New York and San Francisco travel, over that by Panama; that in case of interference by a foreign power would permit massing troops by land transportation through the territory of a friendly and co-operating nation, is at least remakable, as it is a route, which, if we value the experience and engineering ability of those who have endorsed the various lines, stands as the most direct and easily maintained of all. Whether this failure is because the Tehuantepec is the nightmare of the Nicaragua party or because he is as ignorant of its literature as he apparently is of the calm belt or "doldrums" off Panama that will greatly curtail, if not prevent the use of that route by sailing-vessels, who can say?

The assertion about the *Comité Americain* for which he says a sum of 12,000,000 francs or $2,400,000 was appropriated, which the author more than once calls a corruption fund, saying it is still doing its work of bribery and systematic chicanery, might be lightly passed as of no greater probability than others noticed above, were it not for the very direct charge "no respectable bankers should ever have participated in that costly fraud upon the shareholders of the Panama Canal Company, as three firms in New York did." As it is generally known that the firms of Winslow, Lanier & Co., Drexel, Morgan & Co. and Seligman & Co., negociated the transfer of the Panama Railroad shares to the French, advancing at one time, it is said, about $8,000,000 for the purpose, and as they have opened books for subscriptions, there can be but small doubt that they are the three firms referred to. The only basis for this charge of *unspecified* "costly fraud" lies in the above mentioned services, but it is from time to time reiterated, on the principle in use by writers of a certain class, that the most atrocious statement, if presented in varying forms, will effect a lodgment in the minds of careless readers. No attempt, however, is made to trace any expenditure of this fund, and we are left by this reckless asserter without even inferential reference to its employment except in "one of the New York papers wrote strongly against the United States owning land in a foreign country."

There are "independent" journalists who regard any financial transaction not bringing money to their pockets, as robbery and fraud, and convict themselves of a financial purity, that will not bear investigation, by the virulence with which they assail the motives and reputations of others; to such, the employment of an Ex-Secretary of the Navy in a perfectly legimate enterprise, even if it is a mistaken one, can not but be tainted with fraud.

The eleven charges of corruption and subsidisation of the press, coming as they do from a late editor of a Portuguese "Journal of Civilization," who enjoyed the confidence of the editors of the *World* (in its intellectual splendor and isolation) and the *Nation*, and is endorsed by the *Post*, are not of interest to our readers, though probably they are to his friends of the daily press.

The finances of the undertaking are discussed with more or less vigor through four or five chapters, from which one studiously inclined could doubtless extract some idea of their state, with the probably correct conclusion that de Lesseps has not provided for money enough to carry the canal to completion, and that the whole enterprise is near bankruptcy. The wide distribution of the shares, to over 104,000 subscribers, may very possibly have been made with such a contingency in view, i. e., to give a large backing to a demand for government intervention, together with the assumption of the company's liabilities, and the completion of the work. In any contingency a large sum will be withdrawn from the productive capital of the world. If the bed of the canal were raised to an elevation of 75 or 100 feet, it probably will not be impossible to maintain it, a point generally overlooked in the consideration of the routes proposed, and there will only remain for consideration the effect of occupation of the Isthmus by a foreign power. We have kindly advised against that in the case of Mexico, and should probably feel constrained to do so in the case of Colombia.

It does not seem desirable for the interests of these United States that the first interocesanic canal should be built on the Isthmus of Panama. The principal service of a canal will always be the interchange of products produced north of the most northerly possible route, and an immediate and determined commencement on either of these routes would speedily stop the present waste of money at Panama, reserving what is left to more profitable employment.

Four chapters are devoted to a dissertation on the Monroe doctrine and treaties relating thereto; this occasion our author seizes to point out his superiority to our diplomatists.

It will not be surprising to learn that de Lesseps is accused, in italics and ordinary letters, of promising what "he knew perfectly well at the time there was no possibility of accomplishing." His characterization of "a *Brooklyn* clergyman whose financial or industrial opinions nobody knows or cares about," shows needless ingratitude for the endorsement of the *Evening Post*, unless he has not been reading that journal since the fall of '83—and the book is not without flashes of humor, such as "we, the independent and impartial critics of M. de Lesseps' doings in Panama."

A new Atlas of New York City.—MR. E. ROBINSON, of 82 Nassau street, has recently published a new and handsome atlas of New York City, including the "annexed district."

It is in one volume, and the size of the sheets, which are all double page, is about 20 inches by 30 inches. Up to about One Hundred and Thirtieth street the scale is 200 feet to the inch, and above that the scales vary according to the amount of work on the sheets. The streets are marked to denote whether opened, unopened or proposed, and the layout of the Twenty third and Twenty-fourth wards, as proposed by the Park Commissioners, is given in addition to the present state of the same wards. The lots and buildings are marked and the latter colored to show whether constructed of wood, brick, stone or iron; the names of important factories, hotels, and other buildings, are written on them. The elevated and surface roads, hydrants, etc., are marked, and the elevations above tide at street intersections given; the parks, boulevards, rivers, bulkhead lines and proposed improvements are also shown. The block, lot, and house numbers, numbers and occupants of the piers, and dimensions of blocks are marked on in their proper places.

In addition to a large amount of information relating to the present condition of the city, the maps show the old shore lines and water-courses, old turnpike roads and old farm lines and names, with references to the city records. Two index maps are inserted for easy reference.

Great care has been taken in the preparation of the work to ensure accuracy and completeness; the maps are carefully made, and well engraved and colored, forming a valuable atlas of the city. The price of the book is $15, or $25 with each sheet mounted on muslin.

A WRITER to the New York *Tribune* relates the following: "On a certain Tuesday morning a telegram was received per night message by the New York house from a San Francisco correspondent, asking the price of an article sold by the New York firm. The New York house cabled at 10 a. m. to London for the price, and the same was received in London about 3 p. m. the same day, five hours later than New York. The London house wired to Worcestershire for the price from a manufacturer, and received the same per wire at 5 p. m. the same day, Tuesday. London then cabled the price to New York at 5 p. m., and the despatch was received in New York about 12 noon the same day, Tuesday, or five hours earlier than London. New York then wired to the San Francisco correspondent (five hours earlier than New York), who received it when he came down to business on the morning of the same day, Tuesday. San Francisco wired to New York, accepting the price, which despatch was received in New York at 3 p. m. the same day, Tuesday, five hours later than San Francisco. Now note the results:

	Miles.
San Francisco to New York (inquiry)	3,000
New York to London (for price)	3,000
London to New York (giving price)	3,000
New York to San Francisco (giving price)	3,000
San Francisco to New York (accepting price)	3,000
In all	15,000

not counting the dispatches which passed between London and Worcestershire. And yet at the hour of 3 p. m., Tuesday, when New York received the dispatch from San Francisco accepting terms, London was wiring Worcestershire for the said terms. New York stood between the ten hours between San Francisco and London, and hence the surprising results."

Tramway.—The government of Aguascalientes Mexico, is arranging for the laying of a tramway from that city to the cloth factory of San Ignacio, in the suburbs.

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AND

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CLUBBING ARRANGEMENTS,

1886.

The "subscription season" for the most popular American Magazines is close at hand, and inquiries as to our proposed clubbing arrangements are being made. We beg leave to announce, therefore, that on and after JANUARY 1, 1886, the subscription price of ENGINEERING NEWS will be **$5.00** per year; until that date the price and clubbing rates with other publications will remain as given below.

We are now planning such improvements in ENGINEERING NEWS, and negotiating for special work to be done during the coming year, as will cost double any possible increase of income from subscriptions; the long notice of change which we here give enables nearly, if not all, present subscribers to renew at present rates. We intend eventually to publish a class journal which will acknowledge no superior in the world, and we feel so confident of the support of our present patrons that we have no hesitation in venturing on the greatly increased expense necessary to carry out our programme.

If an English engineering journal, carrying fifty pages of advertisements and twenty four of reading matter sells for $10, why may not an American journal of equal merit sell for at least half as much.

In order to accommodate such of our subscribers as may wish to subscribe for other periodicals, we offer the following terms until January 1, 1886: We will send to any address ENGINEERING NEWS at regular subscription price, **$4.00** and the following at the additional prices given:

	Net. Price.	Reg. Price.
Atlantic Monthly	$3.25	$4.00
Century Magazine	3.55	4.00
Harper's Magazine	3.25	4.00
Harper's Weekly	3.25	4.00
Harper's Bazar	3.25	4.00
Harper's Young People (weekly)	1.65	2.00
Popular Science Monthly	4.25	5.00
St. Nicholas Magazine	2.55	3.00
North American Review	4.10	5.00
Cassell's Magazine of Art	3.00	3.50
Cassell's Family Magazine	1.25	1.50

The Century Magazine commences its year with the November Number; Harper's Magazine commences with the December Number. Subscribers should renew these Magazines in October and November.

Subscribers to other publications clubbed with ENGINEERING NEWS, must notify those "other publications" direct, of change of address during the year. After we have transmitted for the year's subscription and had the subscriber's name and address properly entered on the clubbing lists, our connection with the transaction *ceases entirely*. Our margin of five cents on each subscriber does not allow for much extra expense in time and postage and stationary.

WE have commenced the publication of the "Engineering News Popular Library" by the issue of a short reprint called "A Business Man," and we intend to follow this up with further articles in the same form of publication as rapidly as possible. These will be reprints and original papers, and we propose that they will be made as practical and valuable as our best judgment can select. "A Business Man" is not a catchpenny affair, made up of worn out maxims of business known to everybody, but is the result of serious thought, by as mature and well informed a mind as Arthur Helps, who enjoyed the distinguished privilege of being private business adviser of the Queen of England. The essay, while not of recent production, is undoubtedly new to many people, and is now obtainable for a very small sum of money. Every man should read it.

Progress on the New Croton Aqueduct Tunnel.

According to the latest reports, all the shafts on the new Croton Aqueduct are down to grade excepting shaft No. 2, 349 feet deep; in this shaft about forty feet is yet to be taken out before tunnel driving can commence. The total progress in the tunnel proper, to November 7, is 25,108 feet; this does not include about 3,040 lineal feet of shaft-sinking.

The total length of the tunnel from Croton Lake to the crossing of the Harlem river is 148,692 feet; consequently the percentage of tunnel driven is about 17 per cent. Taking the tunnel driving on the three contracts, commencing at Croton Lake, the proportion of the above amount stands as follows: 9,903 lineal feet; 9,694 lineal feet, and 5,509 lineal feet.

The South Pennsylvania Tunnels.

In connection with the official reports on tunnel-driving on the South Penna. Railroad, the second installment of which appears in this issue, we omitted to mention last week, that we are directly indebted for the originals to Mr. Wm. F. Shunk, Associate Engineer, and to Mr. Thomas H. Loomis, Assistant Engineer, in the Harrisburg offices of the Company.

The location of the first five tunnels, commencing at the Eastern end, was made by F. H. Clement, C. E., Division Engineer of Division III. The engineers making these reports and under whose charge the tunnel work was done, were as follows:

DIV. II.—W. H. Atwood, Division Engineer. W. N. Hall, Rest. Eng., Blue and Kittatinny Tunnels. N. O. Whitney, Rest. Eng. Tuscarora Tunnel.

DIV. III.—F. H. Clement, Division Engineer. J. J. Hoopes, Rest. Eng., Sideling Hill Tunnel. S. H. Chauvenet, Rest. Eng., G. W. Cunard, Asst. Eng. Ray's Hill Tunnel.

DIV. IV.—Edmund H. Barnes, Division Engineer. Charles E. Webster, Rest. Eng., Allegheny Mt. Tunnel.

DIV. V.—J. Imbrie Miller, Division Engineer. S. L. F. Deyo, Rest. Eng., Negro Mt. Tunnel. U. S. Lutz, Rest. Eng., Quemahoning Tunnel. John Marston, Rest. Eng., Laurel Hill.

De Lorme and the Chinese Railroads.

The *Pall Mall Gazette* does not propose to leave Baron de Lorme and his prospective Chinese American railway syndicate go unchallenged. The *Gazette* says that the Baron is "not known in English official circles" and wholly discredits the statement that China has authorised any negotiations with Americans looking towards railway construction.

The Chinese Minister at Washington also states that he does not know Baron de Lorme officially and has received no advices regarding his proposed enterprise.

The Baron himself now rises to explain and says in answer to the first challenge that the English financiers are attempting to put him in a false position; that he never made the statement that China had authorised him to negotiate for a railroad; his coming here was a matter of private business, and he came to America because he thought the American railway system was best adapted to Chinese needs, and that it was already preferred by the Chinese authorities who had investigated the matter. He as yet has no business with the Chinese minister.

From all that we can learn Baron de Lorme is well accredited, is associated with prominent American financiers and business men, and is engaged in a legitimate business enterprise that if successfully carried out cannot but be of vast national importance. In any event his proposed syndicate is in direct accord with our own conviction as to the proper course to pursue in extending the field for the employment of American brains, capital and material.

One difficulty that will have to be met is the apparent American distrust in investing heavily in foreign enterprises, a feeling that is in striking contrast with the methods of English capitalists. The Englishman has enormous investments under every sun; some of these are disastrous, but many of them pay large dividends. With his money go English plant, supplies of all kinds and Englishmen to direct the expenditure. A late example is the $59,000,000 contract with the Argentine Republic, elsewhere noted in this issue. This syndicate is just in the line proposed by the Baron de Lorme and his friends; the South American republic has credit but no ready funds, the enterprise promises ample returns, and the Englishmen advance the money and at the same time make a market that is always growing for English goods. The moral of this Argentine contract comes in the fact that this same financial aid was solicited from American capitalists, but was refused, and the opportunity lost that will now go to swell the dividends of English investors and manufacturers, and make work for the laboring classes of Great Britain.

We admire the Englishman's business pluck and enterprise as much as we deprecate the halting method of American capitalists when any enterprise outside our own borders is in question; but we now as a nation manufacture more than we can consume, and our force of trained men, in many branches of the useful arts, outnumber the vacant places within the States. The Englishman is found everywhere on the worlds ;surface where goods can be sold and a busy brain find employment; and we must dispute this territory with him, by all fair, honest means, if we would seek to share the benefit he derives from his individual efforts; and we must do this, as he does it, by transporting American capital and men to the spot that needs it. We must not sit patiently in our shops and await the orders of the South American, Chinese or even the Australian, but we must go after them, and bang at the door until we force admittance and our goods are accepted.

In this connection a word as to another feature of our American plan of not-doing-it will be in season, and that is the sectional jealousy of the daily press within our own borders and their apathy where American profits are to be derived from foreign investments. It is not so long ago, that when asked about the probable influence of the proposed Reciprocity Treaty with the Sandwich Islands, David A. Wells answered, in effect, that "probably a few American planters would be benefited thereby." And within a very recent period

we have seen a legitimate and enterprising foreign project condemned because "it would put money in the pockets of Boston investors." This is not right; it is not the way to promote American interests abroad, nor to command respect for the nation. In any foreign controversy the English projector or merchant is assured of the undivided backing of his home press and the support of ships and armies if need be. Practically, King Thebaw is being whipped to-day for meddling with the pushing of British trade interests in his territory and he will ultimately be forced to accept whatever terms his foe may deem fit to grant, and in these terms English products and English trade will largely figure.

To return to the original subject, China is now the latest field opening to the enterprise of more advanced nations; all Europe will race for the prizes, but the chief prize will be carried off by England, unless lusty America girds up her loins and enters into the struggle with deep seated purpose to at least divide the spoils and with a proper appreciation of the forces really at her command. It remains for our capitalists to say which shall be the result; money and the brains to use it rightly will open the door to a more extended commercial prosperity.

New York Department of Public Works.

We make the following abstracts from the report of Rollin M. Squire, Commissioner of Public Works of New York, for the quarter ending Sept. 30 1885;

The total expenditures for the nine months ending Sept. 30th. were $2,844,851.32; of this amount $1,737,577.03 were on appropriation account; $729,581 for local improvement; $330,-811.80 for funded debt, water supply; $31,113.-27 for restoring pavements and $15,768.15 for water meters. During the quarter, new contracts to the amount of $170,572.29 were entered into and contracts of a total value of $842,901.59 were completed during the quarter.

The Chief Engineer of the Croton Aqueduct reports that during the three months there were only five days when the natural flow of the Croton river was sufficient to supply the daily consumption through the aqueduct. The amount of water drawn from the storage reservoirs to supply the deficiency was 4,220,000,000 gallons. The same conditions prevail in the Bronx supply, where 600,000,000 gallons were drawn from Rye ponds to keep up the supply.

Mr. Squire again complains of lack of appropriation to check the use and waste of water; and warns the city that many pipes contiguous to the water-front, are so worn by corrosion from salt water that there is no guarantee against large breaks and leaks; these pipes should be renewed at once. There were, on June 30, 1885, 12,625 water meters in use; during the quarter 494 additional meters were put in bringing the total, on Sept. 30, to 13,119. For the proper reading and care of these meters, the present force should be doubled.

With regard to the consumption of water, the Commissioner shows that the daily average per head, in certain parts of the city, is 100 gallons, and 'that where there is the greatest complaint of insufficient pressure. The city is now receiving the maximum quantity from the present aqueduct, and the new supply can not possibly be utilized under five years. With an annual increase of population of 50,-000 inhabitants, an equitable distribution of water throughout the city will require a reduction from the present general average of 80 gallons per head to 76¼ gallons in the next year; 73⅜ in the second; 71½ gallons in the third; 69 gallons in the fourth, and 66⅝ in the fifth year. If this reduction is not made, the pressures will be so diminished that in a large part of the city it will be impossible to obtain water even by pumping. The Commissioner shows by the statistics of other cities, that the reduction proposed is possible. He advises first the suppression of waste by the introduction of water-meters and the application of a stop-cock to each service pipe. With a pressure-gauge for indicating or registering the pressure and flow of water and locating leaks or waste.

Under the appropriation for repaving streets, 24,458 square yards of new pavement were laid; the repaving of twenty-five other streets is in progress, and will be completed before the end of the season. In the quarter $\frac{25}{100}$ miles, of gas and steam pipe were laid; $1\frac{7}{100}$ miles, underground telegraph and telephone conduit; $1\frac{25}{100}$ miles of double track railroad; and 3,472 openings were made in streets to repair and make house connections. A force of 545 mechanics and laborers, and ninety-one carts were employed in this service.

An average force of seventy-seven mechanics and laborers and ten carts were employed under the direction of the Water Purveyor in attending to the following principal items of work 389 defects in pipes and stop-cocks; 143 taps shut off to repair leaks; 1,212 fire-hydrants repaired; 180 new fire-hydrants placed and 283 defects in pavement repaired.

The Bureau of Sewers built 4,862 lineal feet of sewers; 103 lineal feet of culverts; rebuilt 785 lineal feet of sewers and put in six receiving basins. The sewerage system of Manhattan Island now includes 409 $\frac{26}{100}$ miles of sewers and 5,025 receiving basins.

On September 30, 1885, there were in use, 23,308 gas lamps, 708 electric lights and 50 naptha lamps.

The Ohio River and her Tributaries.

At the fifth annual dinner of the Commercial Club of Cincinnati, held in that city on the evening of November 12, Capt. J. C. Post, U. S. Engineers, gave an interesting sketch of the scope and success of the work of the U. S. Engineers on the Ohio River and its tributaries. We give these remarks as follows:

"Nearly seventy years ago the inhabitants of the great Mississippi Valley, realizing the immense value of the water courses which generous nature has so bountifully bestowed upon it, applied to Congress for aid to render them less difficult and dangerous to navigate.

These efforts resulted in a clause being inserted in the act of 1819, making appropriation for the military service, providing for the survey of the western tributaries of the Mississippi River, and those flowing into it from the northwest of the Ohio.

In the succeeding year the Ohio was also included. This survey was followed, in 1824, by an act appropriating $75,000 for the improvement of the Ohio from Pittsburg to its mouth, and the Mississippi from the mouth of the Missouri to New Orleans. This was the first appropriation made by Congress for the improvement of our rivers and harbors, and was the beginning of the system which has been continued without interruption, except from 1852 to the close of the civil war. Prior to 1852 the appropriations were principally for removing obstructions which embarrassed navigation, and no large works were undertaken, such as those which have since been commenced. Some of these latter have now been completed, or are so nearly completed that their great value is already appreciated, while others are dragging slowly along, owing to irregular and insufficient appropriations.

Among those whose success is assured, I will mention the Davis Island lock and movable dam, the locks and movable dams on the Great Kanawha, the reservoir system at the headwaters of the Mississippi, the jetties at the mouth of the harbors on the great lakes, and the removal of Hallett's Point and destruction of Flood Rock, New York harbor.

The improvements in which your city is specially interested, are those upon the Ohio and its tributaries. The great valley drained by these rivers, which embraces a portion of more than one-fourth of the States of this country has an area of over two hundred thousand square miles, a territory about as large as the Republic of France. It is rich in agricultural lands, possesses enormous quantities of the finest timber, besides containing more mineral wealth than any other known area of equal dimensions upon the globe. Extensive iron deposits are found in many places, and the vast amount of coal, both cannel and bituminous, which has been discovered is almost without limit.

To develop this section, the United States has removed the obstructions from the Allegheny, which flows through the oil and coal regions where natural gas was first utilized. Upon the Monongahela, the great coal river, two locks and dams have been commenced, one of which is in operation, and the other partly constructed. These, together with the locks and dams built by the Monongahela Navigation Company, will extend slackwater navigation to Morgantown, W. Va., a distance of 102 miles from its mouth, and increase the annual yield of coal from this river, which already reaches the enormous amount of 100,000,000 bushels year. In 1857, before this navigation was established the annual output amounted to only 750,000 bushels.

The Allegheny and Monongahela rivers, meeting at Pittsburg, form the Ohio, and five miles below their junction the recently completed Davis Island dam is located. The construction of this work, which is being successfully operated, gives a ready solution to the problem of constant navigation on the Ohio, a problem which deeply concerns the future prosperity and welfare of this city. Between this dam and the mouth of the Ohio an extensive ice harbor is being made at the mouth of the Muskingum, and numerous dykes and dams have been constructed for the benefit of low water navigation, eleven new ones having been undertaken during the present season. At the falls the new large locks commenced by the canal company have been completed, and a beginning has been made upon a recently approved plan for enlarging the canal. Upon the Great Kanawha three locks and dams, two of the latter movable, have been completed, and two others are being built. It is the intention to extend this system to the Ohio river. Since two of these works began to be operated in 1881, the amount of coal brought out of this river increased in three years from 12,000,000 to over 30,000,000 bushels.

Locks and dams are also being constructed upon the Little Kanawha and Big Sandy rivers to reach the coal fields, and connect them with the Ohio. Four are now in operation upon the Kentucky, and a fifth will be completed this season, if no unusual difficulty occurs. These will give one hundred miles of slackwater navigation, or one hundred miles of river, which will be navigable during the entire year for a draught of 6 feet. The construction of the fifth lock and dam will materially add to the commerce upon this river, which now amounts to over $7,000,000 a year. It is designed to extend this improvement to the extensive coal fields of Eastern Kentucky. Recent examinations have developed the existence of over five hundred square miles of good coking coal in this locality, which upon test, gives a net result of over 4 per cent. more carbon than the famous Connellsville coal. It is found in veins of from 4 feet to 11 feet in thickness, the thicker ones generally being advantageously divided by their layers of shale. This section also contains a greater body of cannel coal than any other known.

Upon the Tennessee the principal work has been to unite, by means of a canal, 367 miles of navigable river above Muscle Shoals with the 255 miles of navigable river below, and thus connect the fertile valley of East Tennessee with the Ohio. The project consists of enlarging and rebuilding the old canal, 14½ miles long, and extending the improvement a distance of 23 miles. This work is now well advanced, and, like many others could have been completed some years ago but for the lack of sufficient means.

I have now briefly called your attention to the principal improvements being made upon the rivers of this valley. I might refer to many others where work has been done to free the natural channels of obstructions with good results, but I will not detain you longer. Much could also be said to remove some of the popular fallacies which exist in regard to these appropriations."

The Export of Locomotives.

We condense from an article on the Baldwin Locomotive Works in the *Industrial Review* the following statement showing the amount and value of the trade.

For the last ten fiscal years our exports have been as follows:

Fiscal Years.	*No.*	*Value.*
1874-75	79	$996,639
1875-76	44	561,559
1876-77	53	568,802
1877-78	98	1,016,974
1878-79	73	567,302
1879-80	60	466,313
1880-81	99	893,123
1881-82	133	1,455,717
1882-83	219	2,219,081
1883-84	282	2,819,946
1884-85	85	732,403
Totals	1,225	$12,297,859

This does not include several shipments by rail for the last year into Mexico and Canada for which no returns have been received.

The destination, number and value of the

locomotives exported during the ten years ending June 30, 1884, is given below:

	No.	Value.
Russia	58	$787,500
Turkey	12	182,000
Sweden	7	59,370
England	8	56,316
France	1	10,000
Spain	9	93,493
Azores	1	1,975
To the Continent	96	$1,190,654
Cuba and Porto Rico	88	$772,911
British West Indies	1	1,800
Hayti and San Domingo	5	30,439
Mexico	167	1,806,399
Central America	22	188,022
Canada and British Columbia	208	1,908,129
U. S. of Colombia	84	700,747
Venezuela	3	17,020
Peru	37	375,664
Chili	31	401,285
Brazil	203	2,050,701
Argentine Republic	72	996,748
Total to South America	430	$4,541,165
Hawaiian Islands	6	$27,567
Japan	2	17,200
Australia	115	1,079,170
Total number	1,140	$11,565,456

The order for forty of the above mentioned locomotives to Russia was obtained by competition with the firms of Europe and England by the Baldwin works, who were successful both in price and time, the engines having to be delivered in running order on Russian territory four months from the receipt of the order. One at least, of the locomotives mentioned above as being sent to England, should be credited to Mexico; transportation having been cheaper by that route than direct from the United States to Mexico.

The largest export, 282 locomotives, valued at $2,819,846, was in the year ending June 30, 1884. They were distributed as follows:

	No.	Value.
U. S. of Colombia	49	$402,005
Venezuela	2	9,870
Chili	19	232,569
Brazil	32	296,113
Argentine Republic	65	906,163
To South America	167	$1,846,720
Mexico	34	341,865
Central America	13	113,604
Cuba and Spain	20	157,377
San Domingo	3	13,225
Canada and British Columbia	27	208,339
Australia	14	107,000
England and Sweden	4	31,616
Totals	282	$2,819,846

This is a very striking exhibit of the superiority of American railway locomotives. Almost every country to which any of these were sent in 1883-84 is now undergoing a period of depression similar to that prevailing here, and in most cases even worse. It is not likely that the foreign demands for new railroads will revive as promptly as it will in this country, and as proof we find that in 1884-85, the year ending with June last, only eighty-five locomotives were exported, valued at $732,403. Of these the Baldwin Works sent out four out of five, which was the fair proportion of this export trade they have at all times sustained. Some ten or twelve locomotives, for which no return was made, were sent to Mexico over the Central Railroad from the Baldwin Works.

The Baldwin works have always given attention to foreign business, and during the flush times of 1881 they refused home orders to fill foreign ones; as a consequence nearly one-half their business in 1884 was on foreign account. After the periodical "booms," during which efforts were only made to increase production, comes a time of increased capacity and diminished orders. It is then, the capital and skill being firmly on the ground, that efforts for decreased cost of production are successfully made so that the demands of each succeeding wave of high activity are more easily met and at lower prices.

Brick Pavements.

The very recent decision of Galesburg, Ill., to lay brick pavements, reminds us that the experience of several Illinois towns in the use of brick for pavements will be of interest and possibly of profit to others. The problem of paving the streets of the smaller cities, differs considerably from that for the larger ones. Wood wears out too soon, the dust from limestone blocks is sufficient to condemn that surface, and granite is too costly. The experiences of Bloomington, Jacksonville, and a few of the smaller cities, show that a brick pavement is very durable, noiseless, clean, smooth and yet rough enough to afford a good footing for horses.

Bloomington is the pioneer in this matter, having used brick for pavements, since 1876; the repairs on the principal streets, under the traffic of a city of 20,000 inhabitants, have been very trifling, and, it is believed, then only due to careless filling of trenches made in connecting with gas, water and sewer pipes, before the pavement was laid. As illustrating the strength of this pavement, when well laid, it is reported that, through defective connection with a sewer, the earth washed out, forming a hole as large as "two hogsheads" over which the ordinary traffic passed for at least several weeks, and over which several heavily loaded wagons and a steam fire-engine certainly passed.

Wherever laid it has met opposition as not being durable, but is giving entire satisfaction wherever tried. Bloomington now has 7 miles, 40 to 50 feet wide.

The construction of the pavement is as follows. The natural surface is rounded up or crowned in the middle about 1 to 25. About 4 inches of coarse sand or cinders is then spread evenly over the surface, cinders being preferred on account of the greater porosity. The surface is then covered with well burned bricks laid on their side, breaking joints. The surface is then swept with fine, dry sand, carefully and thoroughly worked into the joints with a stiff rattan stable broom. This is an important item.

An inch of sand is then spread over this foundation. The wearing surface consists of a course of brick set edgewise, breaking joints. It is counted very essential that the bricks, particularly the top course, should be set very close, and have the sand thoroughly swept into the joints.

The bricks used are hard, well burned, of regular form, and uniform size, differing only from ordinary hard brick by being tougher. The toughness is secured by using ⅓ "blue" clay to ⅔ of ordinary brick clay. The very best of ordinary brick when used in this way will crumble at the edges under the horses' feet; but with brick made as above, even a sharp shoe will slide or grind down the surface without detaching a chip.

The total cost of the pavement varies from $1.40 to $1.80 per square yard, according to the proximity of sand banks and brick yards.

It may be that brick pavement is the thing for the less frequented streets of the larger cities. We believe the citizens of St. Louis laid a trial section on 4th street, but we have seen no report of the result.

PERSONAL.

MR. GEORGE HELM, who has been roadmaster on the Texas & St. Louis, R.R., has been appointed trainmaster of the Houston & Navasota division of the Gulf, Colorado & Sante Fe, R. R., with headquarters at Temple, Tex.

The following is a partial list of the officers of the Chicago, Burlington & Northern R. R., as far as appointed. President A. E. Touzalin, St. Paul, Minn.; manager, Geo. B. Harris, St. Paul, Minn.; superintendent, W. H. Holcomb, La Crosse, Wis.; assistant superintendent, J. M. Barr, Savanna, Ill.; auditor, N. B. Hinckley, St. Paul. Minn.; cashier, G. W. Traer, St. Paul, Minn.; chief engineer, north division, C. C. Upham, St. Paul, Minn.; chief engineer, south division, W. B. Lawson, La Crosse, Wis.; consulting engineer on bridges, O. Chanute, Kansas City, Mo.; purchasing agent, Geo. Hargreaves, Chicago, Ill.

THE engineering department of the Mexican Central R. R., has been abolished and the work transferred to the superintendent's department.

MR. H. W. ELMER has been appointed division roadmaster of the Hartford & Connecticut Western R. R., and will have charge of the line from Hartford to Millerton.

MR. ANDREW SMITH, has been appointed superintendent of the Albuquerque and Arizona divisions of the Atlantic & Pacific R. R., with headquarters at Albuquerque, N. M.

W. H. SPRADLIN, Chief Engineer of the Chesapeake and Nashville Railway, now under construction, was married on the 12th to MISS MARY F. RUTLAND, of Scottsville, Ky.

THE death is announced at Oakland, Cal., of THOMAS B. MORRIS, civil engineer, who had charge of the building of the Pacific division of the Northern Pacific Railroad.

A PARTY from the United States Coast and Geodetic Survey arrived at Ithaca, N. Y., November 13th, to make experimental researches with pendulums. A station will be situated on the Cornell University grounds. The party will remain there several days.

THE President has appointed JAMES C. STRANGHAM, of Indiana, to be surveyor general of Idaho; JAMES DAWSON of Colorado, to be surveyor general of Colorado; JOHN HISE of Arizona to be surveyor general of Arizona.

J. S. WATTLES having resigned as general roadmaster of the Fremont Elkhorn & Missouri Valley and Sioux City & Pacific R. R., that office is abolished. MR. W. T. KELLEY has been appointed supervisor of track between Valentine and Chadron, Neb., with headquarters at Gordon, in place of H. Bruning, resigned.

WILLIAM H. GUILD, of the firm of Guild & Garrison, Brooklyn, New York, died on the 11th at the age of 53. MR. GUILD was born in Connecticut, but at the age of 16 came to Brooklyn, where he has lived ever since. He succeeded his father in the old established firm above referred to, and was much esteemed for his ability as a mechanic and his uprightness as a man.

AZARIAH BOODY, one of the oldest, and formerly one of the most extensive railroad builders in the United States, died on Nov. 18 of pneumonia at 8 West 58th St., New York. He was born at Standstead, Ontario, Canada in 1815. Early in life he settled in Rochester, in this State, where he began business as a contractor on the New York Central Railroad. He served one term in Congress as a representative from the Rochester district. He was for a long time President of the Toledo and Wabash Railroad. Lately he has spent his winters in Florida, where he was engaged in the lumbering trade. and shipped a large amount of railroad ties north. At one time he was a partner of Sidney Dillon's.

COMMODORE GEORGE E. BELKNAP, Superintendent of the Naval Observatory, in his annual report renews the recommendations of his predecessors for the removal, at an early day, of the plant of the observatory to the new site selected and purchased for the purpose in 1880. It would, he says, take three years from the time the appropriations are made to erect the buildings, transfer the plant, and get everything into good working order. From its humble beginning in 1838, he says, the observatory has now grown to be one of the most important astronomical centers in the world, and it is to be hoped that Congress will recognize the good work hitherto done by granting means to place the institution on a still higher plane than it now occupies. He recommends the recognition of assistant astronomers of the institution as permanent attachés, with suitable provision

for longevity pay, in order that sufficient inducements may be offered to secure the continued service of men trained in the institution.

THE following is from the Denver *Tribune*:

"Cook's detective office and Chief of Police Hogle received the following telegram recently:

SAN FRANCISCO, November 10.

CALVIN PRATT, a railroad civil engineer left here November 7th with $14,000. He is well known in you, section. Arrest him for forgery and secure the money Age, 36; six feet tall; weight, over 205; portly looking man, dark, rosy complexion, dark hair and moustache, beard about a week old.

HARRY N. MORSE."

Pratt came to Denver in the spring of 1880, remaining until late in the fall of 1882. He came rom the Atchison, Topeka & Santa Fe railroad, where he had acted as assistant to A. A. Robinson, chief engineer of the road, and brought with him some very tall letters of recommendation as to his qualifications as an engineer and nobility of character. These credentials secured him the position of chief engineer of the Denver, Utah & Pacific road then building, and while his ability as an engineer was unquestioned it soon became plain tha this character was none of the best.

In the fall of 1882, Pratt was engaged by the Oregon Railway and Navigation Company at Portland and remained with them about two years when he went to San Francisco. The money from the forgeries above referred to was obtained mostly in Portland.

General Cook's telegram was received at 2.30 on Tuesday the 10th, just in time to watch the incoming trains, but he was not to be found. Nothing has been seen of him since, and as it is now the 14th, Calvin Pratt, C. E., is probably just over the borders of the Happy Land of the Canadian Canaan, where bloom the fat and festive Mandelbaum, the wary Cashier Scott, President John C. Eno of the Second National Bank, and other choice American aristocrats. However, the local officers hope Pratt will be caught in New York or Philadelphia.

The Great Chinese Railroad Scheme.

WASHINGTON, November 16.—The Chinese Minister in this city knows nothing whatever of Baron De Lorme, who is in New York negotiating for the construction of railroads in China, and he considers it very remarkable that any one should come in this country on such a mission without bringing at least a letter of introduction to him. Viceroy Lee, who is the head official in the line of public improvements in the Empire, is an old official associate and intimate friend of the Minister, and would undoubtedly have given Baron De Lorme a letter of introduction had he been aware of the object of his visit. It is also considered singular that the banking firm of Russell & Co., who are the fiscal agents of the Chinese Government in London and New York, and are the leaders in all these enterprises, do not appear in the scheme. The Minister has heard nothing from this firm regarding the matter, and is aware that the Government never enters upon a movement of the kind without consulting or, at least, informing them.

Russell & Co. have recently negotiated a loan for the Chinese Government in England for railway purposes, and it was supposed that no further steps would be taken at present.—N. Y. *Sun*.

The *Pall Mall Gazette* says that Baron de Lorme, quoted recently in American newspapers as informing several leading American capitalists that the Emperor of China was anxious to have Americans build railways in China, is not known in English official circles, and the statement that China had authorized any negotiations with an American syndicate with a view to the construction of railways in that country, is wholly discredited.

The American Society of Civil Engineers.

At the meeting of the Society on Wednesday evening the regular business was postponed until the next meeting, in order to accept an invitation, tendered through Robert L. Harris, Member of the Society, to witness the last experimental trip of the Daft electric motor before it is put into daily operation on the 9th Avenue elevated road.

Before the adjournment of the Society, Mr. Marshall, Member of the Engineers' Club of Philadelphia, exhibited and briefly explained an ingenious but simple device for drawing railway curves of any desired radius. The instrument is practically a straight-edge with two sliding arms carrying a pencil point; the curve drawn is mathematically correct, and can be made without reference to the material center of curve. By it the tangent to any curve at any point can also be readily found.

The trip on the Daft motor was successful; including a five-minute stop, it took seventeen minutes to go from the 14th street station to 50th street with two cars filled with passengers. The up-town run was made slow to show the ease with which it could mount the grades; the return trip was made in seven minutes, about as fast as the ordinary steam motor.

Engineers' Club of Philadelphia.

Record of Business Meeting, November 7th, 1885.

Past President Henry G. Morris in the chair; 45 members and 4 visitors.

The following gentlemen were elected Active Members of the Club: Messrs. Joseph B. King, John W. Campbell, Col. Wm. P. Craighill, R. R. Bridgers, Jr., George E. Datesman, Allan Cox, Henry E. Tripler, J. H. Covode, John Wilson, Pedro G. Salom, Theo. Low, Jacob B. Rohrer, Emile Low, Sutherland M. Prevost, and Chas. S. Churchill.

The Secretary read extracts from various communications from Mr. Wm. T. Blunt, Secretary of Committee of Civil Engineers' Club of Cleveland, relative to the proposed Convention of representatives of the Engineering Societies at Cleveland, December 3d to 5th, 1885, "to consider and report what action, if any, is advisable in the matter of obtaining the passage of new laws which shall provide for the better condition of Civil Engineers employed on Government Works, other than Military." In response to the invitation to the Club to send a representative to this Convention, the Secretary nominated Mr. E. L. Corthell, who was unanimously elected by the meeting.

Mr. Horace See, Chairman of Committee appointed to convey to Mr. T. Roney Williamson, Architect, Member of the Club, the thanks of the Club for his professional services, presented a communication which was heartily endorsed by unanimous vote.

Mr. F. H. Bowen, Jr., presented a description of the Albo-Carbon Light, illustrated by a chandelier which had been placed in operation in the room. The Albo-Carbon Light is an English invention. The light is obtained from the combustion of illuminating gas, such as coal, oil and water gas, with albo-carbon (naphthaline) in air. The latter is placed in a spherical reservoir, in which are several tubes, communicating with the outside gas supply and with the burner. A plate, connected with the reservoir, extends over the generator burner and serves to receive and conduct the heat to the reservoir. The action of the light is as follows: the gas, on being turned on, runs through the reservoir, and thence by a pipe to the burner, where it is lighted. The heat of the flame is taken up by the projecting plate and conducted to the reservoir, where it melts and vaporizes the carbon, and the vapor immediately mixes with the incoming gas, is taken up by it and consumed. The incoming gas is heated before it reaches the reservoir, and serves to volatilize the naphthaline. It is claimed that the brilliancy and whiteness of the light are thus greatly increased, that a series of tests showed that ordinary 16-candle power gas was raised to 44-candle power, and that, in large lights, even better results were obtained. This is claimed to be due, first, to the heating (regenerating) of the gas; and second, to its enrichment. The naphthaline is a white crystalline solid, obtained in the distillation of coal tar. It melts at 175° F., and boils at 414° F., giving off a vapor, whose density is 4.528. The system has been in use on the railways of France and England. The appliances may be connected to ordinary gas fixtures.

Mr. James Christie presented a paper upon "The Adaptation of Steel to Structural Work." The price of steel has now fallen so low, as compared with iron, that its increased use will be actively stimulated, as the building industries revive. The grades and properties of the steels are so distinct and various, that opinions differ much as to the adaptability of each grade for a special purpose. Hitherto engineers have favored open-hearth steel on account of uniformity, but recent results obtained from Bessemer steel tend to place either make on equality. The seeming tendency is to specify what the physical properties shall be, and not how the steel shall be made.

For boiler and ship plates the mildest and most ductile steel is favored. For ships frames and beams a harder steel, up to 75,000 pounds tenacity, is frequently used. For tension members of bridges, steel of 65,000 to 75,000 pounds tenacity is usually specified, and for compression members, 80,000 to 90,000 pounds. In the Forth Bridge, compression steel is limited to 75,000 to 82,000 pounds. Such a marked advantage occurs from the use of high tension steel in compression members, and the danger of sudden failure of a properly made strut is so little, that future practice will favor the use of hard steel in compression, unless the material should prove untrustworthy. In columns, even as long as forty diameters, steel of 90,000 pounds tenacity will exceed the mildest steel 35 per cent., or iron 50 per cent., in compression resistance.

The present uncertainty consists largely, as to how high tension steel will endure the manipulation usual with iron without injury. A few experiments were recently made by the writer on riveted struts of both mild and hard steel, which had been punched, straightened and riveted, as usual with iron, but no indication of deterioration was found.

Steel castings are now made entirely trustworthy for tensile working tresses of 10,000 to 15,000 pounds per square inch. In some portable machinery, an intermittent tensile stress is applied of 15,000 pounds, sometimes rising to 20,000 pounds per square inch of section, without any evidence of weakness.

The Secretary presented, for Maj. H. W. Clarke, a Table of Chains, Reduced to Feet, for the Reference Book.

Mr. Rudolph Hering read some interesting extracts from a Report of a Committee of the City Councils of Philadelphia, made in 1801, on the first works built to supply the city with water from the Schuylkill river, the pumping station of which was at Centre Square, on the site of the present City Hall.

Mr. Henry G. Morris exhibited a fine specimen of a copy of tracing in blue lines on white ground.

HOWARD MURPHY,
Secretary and Treasurer.

The Cleveland Convention.

The following engineers have expressed their intention to be present at the Cleveland Convention of December 3, 4, and 5, as representatives of the Societies accompanying their names:

St. Louis, J. A. Ockerson; Southern, M. C. Kollock; Chicago, L. E. Cooley; Michigan, Prof. J. B. Davis; Cleveland, John Eisenmann; Philadelphia, E. L. Corthell; St. Paul, H. E. Stevens; Indiana, Walter A. Osmer; Minneapolis, Prof. Wm. A. Pike; Missouri, Prof. T. J. Lowry.

St. Louis Engineers' Club.

At the meeting of the Club on the 4th, Thos. McMath was elected a member, and W. B. Knight, C. E., of Kansas City, Mo., proposed for membership.

A paper by Mr. C. W. Clark was then read, entitled "Notes on the Influence of Inclination of the Limb and of the Axis of a Theodolite on the Measurement of Horizontal Angles," and discussed at length by Prof. Johnson.

In the general discussion Mr. Hill gave the result of some tests of cement and sand bricks, mixed 4 of sand to 1 of cement. They were twenty-six days old and averaged about 125 lbs. per square inch in compression; Mr. Russel gave an instance where common clay stood 135 lbs. per square inch in tension; various other subjects were commented upon.

Michigan Engineering Society.

The Annual Convention of this society will be held at Lansing, Mich., on Jan. 26th, 27th, 28th, 1886. The following is a partial programme:

TUESDAY, JAN. 26, 2 P. M.—Reports of President and various permanent committees, appointment of new committees and organizations of sections. 7:30 P. M.—Address of the President, "Technical Education."

WEDNESDAY, 9 A. M.—Meeting of standing committee to pass on papers to be read. 9:30 A. M.—Meeting of the society in three separate sections as follows: Section A, Surveying; Section B, Civil Engineering; Section C, Mechanical Engineering. 2 P. M.—Excursion to various points of interest at University. 7:30 P. M.—Address before the whole society.

THURSDAY, 9 A. M.—Continuation of excursion. 2 P. M.—Meeting of societies in three separate sections. 7 P. M.—Meeting of standing committees. 7:30 P. M.—Address before the whole society—general session.

Western Society of Engineers.

Two papers were read and discussed at the Meeting of Nov. 2nd.

"Amount of Horse-Power Used in Propelling Street Cars." By A. W. WRIGHT.

"The Relative Expenses of Some Items of Operating Upon Narrow and Broad Gauge Railroad." By C. H. HUDSON.

At the meeting held Tuesday, November 17, a paper was presented by E. J. WARD on "The Feasibility of an Inverted Siphon Tunnel for Improving the Water Power of the Illinois River at Marseilles."

Liverpool Engineering Society.

The usual fortnightly meeting of this society was held on Wednesday, the 28th inst., at the Royal Institution, Colquitt-street, Mr. W. E. Mills, president in the chair. A paper by Professor Hele-Shaw, (University College, Liverpool) entitled, "Recent Researches on the Nature of Friction and the Action of Lubricants," was read by the author. The author in the first place briefly reviewed the steps which had been made in the progress of our knowledge of friction, and pointed out that General Morin's results and conclusions, both on the sliding and rolling contact of surfaces, published between 1830 and 1834, had until recent years been regarded as final. During the last ten years, however, many scientific men had worked at the subject, and much light had been thrown, not only on the sliding and rolling friction of solids, but on the friction of liquids and gases.

The author in the present paper confined his remarks entirely to the sliding contact of dry and lubricated surfaces of solids. Commencing with the friction of dry surfaces, it has for some time been admitted that the so-called laws of friction usually given in text-books are probably never exactly true under ordinary pressures and velocities, while they lead to every erroneous conclusions if applied beyond moderate limits, and the experiments of Ball, Douglas Galton and Westinghouse, Fleming Jenkin and Ewing, Poirée, and others were alluded to in proof of this. In discussing the actual nature of friction of dry surfaces the author believed that more careful and elaborate observations of temperature at extreme velocities and pressures were needed.

Coming to the subject of the contact of lubricated surfaces, a far greater advance had been made. The work of Thurston and the experiments made by the committee of the Institution of Mechanical Engineers were of great value, and the main results were brought forward. A striking feature in the progress of the subject was the increasing use of testing machines, and those of Thurston, Stapper, and Bailey were exhibited and described.

In conclusion the author stated that the question of lubricants was of immense importance in marine engineering, and, while large sums of money were being annually saved in railways by scientific lubricant tests, the mode of judging the efficiency of lubricants used for marine engines remained of the most crude nature, and this alone, in a place like Liverpool, was, he trusted, a sufficient reason for bringing forward the present paper.

Ohio Surveyors.

The Ohio Society of Surveyors and Civil Engineers will hold its Seventh Annual Meeting in Columbus, Ohio, on January 12,13,14, 15, 1886, Headquarters will be at the Park Hotel where reduced hotel rates will be given to all attending the meeting. Efforts are being made to make the programme of exercises superior to that of any previous meeting of the Society. All who are interested in engineering work are cordially invited to meet with the Society and take part in its proceedings.

Full programme of exercises will be announced soon.

BENJ. THOMPSON,
Secretary.

CORRESPONDENCE.

Index to Periodical Literature.

ITHACA, N. Y., Nov. 11, 1885.

EDITOR ENGINEERING NEWS:—I write to enquire through your columns if the Index Department has been suppressed?

I have enjoyed it very much thus far.

C. L. CRANDALL.

[From the very limited interest which it appeared to us, the Index above referred to, created among our readers, and knowing the value of the space allowed and the labor expended for it, we did think of abandoning it to some more enthusiastic contemporary. We are, however, arranging for a monthly supplement relating exclusively to scientific literature, and it is probable that our index will form a part of that supplement. A more copious index of foreign publications is intended. We have not yet decided in what issue of the month such supplement will be published.—ED. ENG. NEWS.]

Drilling Power on the South Pennsylvania Tunnels.

NEW YORK, Nov. 18, 1885.

EDITOR ENGINEERING NEWS:—In your issue of the 14th, in the article under the heading of "Reports on Methods of Working Tunnels on the South Pennsylvania Railroad" I find that the answer to question No. 17, *i. e.*

"What is your greatest difficulty?" was accounted for as follows on the tunnels named:

Blue Mountain, east end.—Lack of drilling power.
Kittatinny, west end.—Lack of drilling power.
Tuscarora, both ends.—Lack of drilling power.

Permit me to state that on all of these tunnels the same number and size of drills were used, *i. e.* 3½ inch and 3¼ inch cylinders, with the exception of Kittatinny, where 3¼ inch machines were used exclusively. Taking the tunnels in order as above mentioned, in the east end of Blue Mountain, where a lack of power is charged, the air was supplied by an 18 in. × 30 in. compressor with boilers of ample capacity to furnish the requisite steam. On the west end of the same tunnel, where no lack of power is mentioned, the same number of drills as was used in the east end were run effectively with a 16 in. × 24 in. compressor which furnishes 162 cubic feet of air per minute *less* than the 18 in. × 30 in. used at the east end. The drills and compressors are of the same make and construction, therefore the difficulty cannot be attributed to the machinery, but to its misuse on the east end as against its competent handling on the west end.

At Kittatinny, lack of drilling power is mentioned at the west end; certainly some one is in error for this statement, as is proved by the letter of Messrs. Evans & Ackerman, the contractors, given herewith.

In this letter they distinctly state that they not only had *ample* power but a *surplus*, and were never required to run the compressor to its full capacity to run the drills efficiently. It is well to state in this connection that the compressor at Kittatinny (20 in. × 30 in. cylinder) supplied the air for running the drills in both the east and west ends. The capacity of this compressor is 654 cubic feet of atmospheric air per minute, or 82 cubic feet less than was supplied to any other tunnel on the entire line; and notwithstanding this, and the fact that from eleven to fourteen 3¼ inch machines were in constant use, the contractors state that they had a surplus of power. Comparing this with Tuscarora, where it is stated that there was a lack of power in both the east and west ends, it is found that two 16 in. × 24 in. compressors of a combined capacity of 736 cubic feet of atmospheric air per minute, supplied the drills in these two headings; a compressor being located near each portal. In each heading only two 3½ inch drills were used, the remaining three being 3¼ inch.

Comparing the conditions at Tuscarora and Kittatinny, it is found that at Tuscarora two compressors of a combined capacity of 82 cubic feet of atmospheric air per minute in *excess* of the one compressor used at Kittatinny supplied air to six 3¼ inch and four 3½ inch drills or a total of ten machines; while at Kittatinny the one compressor of 654 cubic feet air capacity per minute supplied from eleven to fourteen 3¼ inch machines. Evidently the difficulty was not in the machinery. It is but fair to the constructors of machinery on such work that a true statement of conditions should be given. In the statement as published in your issue of 14th, there is an implied criticism of the machinery supplying the power—which in view of the above facts is entirely erroneous; but even had there been a lack of power it would have been a deficiency which could only have been remedied by the contractors themselves procuring additional power.

F. M. PIERCE.
President, Ingersoll Rock Drill Co.

KITTATINNY TUNNEL.
SHIPPENSBURG, PA., Sept. 7, 1885.

F. M PIERCE, PRES.
Ingersoll Drill Co., New York:

Sir:—In reply to yours of the 4th inst., we will say that we have driven over 4,000 feet of this tunnel since July 1st, 1884, from the headings, 1,900 feet for double track, the remainder for single track railroad, the greater portion of it through hard sandstone. We have used but one of your Class A. compressors, 20 in. × 30 in. cylinders; and twelve 3¼ inch "Eclipse" drills. We think it would be folly to provide more machinery to run this or any other tunnel that is worked from two headings (unless for hoisting or pumping if required). We have never run this machine to its capacity, and it is now doing the work easier than ever it did. We know of no better evidence of your machinery to do good work than to refer to the work it has done for us.

Respectfully yours,
EVANS & ACKERMAN.

WATER

THE water-works at Muscatine, Iowa, owned by a private company, will be purchased by the city.

TAYLORVILLE, Ills., opened bids for new water-works Thursday, November 5th.

HILLSBORO, Ills., contemplates building water-works soon.

THE city of Jeffersonville, Ind., is in debt $375,000, and must borrow money to pay the interest.

THE Georgia Central Railroad is boring an artesian well at Reynolds, Ga.

CITIES in eastern Iowa which have tried it declare the tower system of electric lighting is no good and advise that lamps be hung low in the street.

THE City Council of Charleston, W. Va., have granted E. R. Davenport, contractor, additional time in which to complete the water-works of that place, from January 1, 1886, to June 1, 1886.

THE artesian well at Albany, Ga., affords 150,000 gallons of water a day.

THE gas works company of St. Augustine, Florida, is rapidly piping the ancient city. The tanks are building with great speed.

THE city council of Texarkana has let the contract for the erection of water works to Mr. Kelley, of Georgetown, Texas, at a cost of $41,000.

DARIEN, GA., Nov. 14th.—At a depth of 482 feet a vein was struck, and a good stream of water is now flowing out of the top of the artesian well.

FORTY-FIVE irrigating ditch companies, with a capital of $1,500,000, have been incorporated in Wyoming territory this year. A vast amount has been spent in the work mapped out by these companies.

THE Independent Natural Gas Company, of Pittsburg and Alleghany, proposes to run a pipe line from Murraysville to the cities indicated. The capital stock is $50,000. The directors are H. H. Byram, Charles L. Caldwell, C. B. Shea, Murray A. Verner and C. C. Dickey.

THE Standard Oil Company is building a huge sewer at Olean, N. Y., from its works to the Alleghany river for the purpose of carrying off the refuse matter from refinery, acid and chemical works. It is one mile and a half long.—Rochester *Democrat & Chronicle*.

THE Board of Trade at Newark, N. J., has appointed a committee which shall present to the Common Council the matter of dyking and draining the meadow lands lying north of the Lister ditch and west of the line of Avenue I.

THE Department of City Works, Brooklyn, ordered Baisley's Pond at Jamaica to be cleaned, and several steam pumps were sent there to drain the pond into the conduit. It was found that the bed of springs yielded water as fast as the pumps could draw it up, and after a week's labor the volume of water was not decreased. The rainfall also interfered with the work and the cleaning had to be abandoned.

THE new reservoir dam lately built by the town of West Brookfield, Mass., to supply water to the fountain on the common was washed out Wednesday, 40 feet of the dam giving way. A flash board had been left in the sluice, and no one was near to watch it, though it is a matter of public concern. The late rains undermined the dam.—Worcester *Spy*.

THE stations on the line of the Brooklyn Elevated Railroad, as well as the yards and switch tables, are soon to be lighted by electricity. A contract has just been made with the Consolidated Company for one year's lighting. Incandescent lamps will be used in the stations and arc lights in the yards. About three hundred will be required. This will make it the only road in the world so lighted.

A WELL has been sunk at Springfield, O., and it is stated by the *Globe Republic* of that city, that it is flowing at the rate of 4,700 gallons per minute. The city uses only a million of gallons per day. Should the well be accepted by the city a pipe would be laid from the wells down the line of the railroad or creek to the vicinity of the water-works engine house, to convey the water to the spot where it can be utilized for city purposes.

Two substantial companies have been organized at Springfield, O., to bore for natural gas. One is the "Citizens' Natural Gas Company," incorporated by G. H. Frey, O. S. Kelly, A. S. Bushnell, P. P. Mast, J. H. Thomas and Robert Johnson, with $300,000 capital. The other is the "Springfield Natural Gas and Oil Company," incorporated by C. C. Funk, D. F. Minahan, E. S. Wallace, W. H. Pretzman and Randolph Coleman, with $100,000 capital. No less than nine new wells will be commenced in a short time.

A TRIUMPH of mechanical skill has been achieved by the National Meter Company in the construction of the two 10-inch water meters now on exhibition in the handsome show-window to their offices and warerooms at 252 Broadway.

These meters were built to order for the town of Harrison, N. J., and are designed to measure the entire water-supply of that place, which is derived from an adjoining city.

From their new circular, bearing date of Oct. 1885, it appears that the National Meter Company have made and sold over 33,000 water meters, and that the Crown Meter, which was put upon the market but little more than five years ago, is already used and adopted by no less than 350 cities and towns in the United States, the Dominion of Canada, and abroad. This company report an unabated and steady influx of orders from all sections of the country, and a visit to their extensive works, which are equipped throughout with the latest improved machinery and tools, presents a scene of the greatest activity, both in the water meter and gas engine departments, which are manned by a large force of skilled workmen.

It is the experience of the National Meter Company that "nothing succeeds like success."

THE Lincoln, Neb., Land Company has extended its system of water-works so as to supply water for another large addition to the place.

THE Clinton, Ills., Natural Gas and Heating Company, has been chartered, and will commence prospecting for a gas supply at once.

THE contract to build the water-works at Neillsville, Wis., was awarded to Philip Buehner, of St. Paul, on November 6th, 1885.

THE consumption of water in Milwaukee for the week ending November 7th, was 106,677,280 gallons. The average daily consumption was 15,239,611 gallons, an average daily increase of 1,451,785 gallons. No account of the beer is apparently kept.—Oskkosh (Wis.) *Northwestern*.

DRAINAGE.—According to the Gibson, Ills., *Courier*, places in the Vermilion swamps never before known to be dry, have been thoroughly drained by the Vermilion ditch, yet unfinished.

IN Clinton, Dewitt county, Ills., a stock company was organized to bore for natural gas. In a number of places in the east-central portion of the state gas has been used from six to ten years in a small way to light and warm houses. The company feel confident of discovering gas.

A STOCK COMPANY is being organized for the purpose of boring for gas in Middletown, Ohio. The shares, $100 each, are being taken rapidly. Since the electric light and gas companies have been consolidated the prices have been advanced.

A NATURAL GAS COMPANY has been organized at Scottdale, Pa., with a capital stock of $5,000. The parties interested are P. S. Loucks, A. C. Overholt, N. B. Miles, H. C. Overholt, C. L. Graff, Geo. K. Miles, J. M. Ward, Geo. H. Zurell, J. H. Campbell, W. N. Porter and Thos. Tennant. A charter has been applied for and work will begin as soon as it is obtained.

CITY ENGINEER BENZENBERG, of Milwaukee, Wis., estimates the cost of the proposed new pumping station for the west side at $135,000, of which there is allowed for the necessary grounds and grading, $8,500; for buildings including engine-house, boiler-house and coal-shed, $25,000; for pumping machinery, $30,000; for boilers and connections, $5,500; for foundations, $4,500; for standpipe and connections, $16,000; for 5,000 feet of 30-inch supply pipe, $26,000; for specials, gates and pipe-laying, $9,500; contingencies, $10,000.

A NEW PIPE LINE.—It is likely that the National Tube Works will be awarded the contract for furnishing the 6-inch wrought iron pipe necessary for laying a new pipe line, which will, when completed, carry oil from the Franklin oil field to New Castle Junction—a distance of eighty-six miles. The company operating the new line is the Independent Pipe Line Company. Its organizers are Messrs. J. H. Rossiter, of New York, and William Smith of New Castle Junction. The line will pass directly through the Bald Ridge field, where the Phillips gusher was struck a short time ago. The surveys were completed last week, and it is the intention of the company to push the work to completion by January, 1886.—Scranton *Republican*.

NATURAL GAS SUPPLY.—If it should prove that a permanent supply of this gas is to be found nearly coincident with our coal and petroleum fields, decided industrial results may be expected. This is clearly indicated by the effect which is noted in Pittsburg. Wherever the gas can be obtained, the cheapness and convenience of fuel and light will attract business. Such places will enjoy a natural industrial preëminence. The long continued flow of natural gas in some of the Hungarian mines, from various points in the country around the Caspian Sea, and in China, where it has been utilized for centuries, give hopes of the permanence of these discoveries in our own country.—San Francisco *Bulletin*.

THE *Evening Post* calls attention to one great and imperishable achievement of the Pullman experiment, namely, the extraordinary low death rate of this town. According to the recent annual report of the company, the population of the town consists of 1,381 households, embracing 3,752 men, 1,945 women, and 2,906 children; total, 8,603. The number of deaths occurring during the past six months was twenty-nine, and the average from the beginning has been only seven per thousand, as against twenty-one or twenty-two per thousand in the average of American cities. This unprecedented result transcends the dreams of the sanitary profession, and must be attributed to the unique system of drainage introduced and put in operation before the inhabitants were allowed to occupy the houses. By the system adopted no sewage is permitted to remain within the inhabited precincts more than two hours. Everything is removed by pumping machinery to a distant point and spread upon agricultural land before fermentation begins. Therefore no sewer gas is ever formed, either in the town or out of it, from the proceeds of drainage. That which commonly goes to the production of diptheria among children, and of typhoid among adults, becomes a valuable fertilizer of the soil.

SCHENECTADY, N. Y., water bonds to the amount of $30,000, bearing 4 per cent. interest, redeemable in 1903 and succeeding years up to 1917, were sold in one lot at auction on the 17th. They were bought at 113 by Ogden, Calder & Co., of Troy, who resold them at private terms to Moller and Co., of New York. The bonds are supposed to be for the Citizens' Savings Bank of New York. The New York bankers, of whom about a dozen were at the sale, say that the price is the highest ever paid for 4 per cent. municipal bonds.

AN immense iron reservoir, 22½ feet in diameter by 110 feet high, is being constructed by the Marblehead Water Works Company, on an elevation in the town of Swampscott, Mass., to supply the towns of Marblehead, Swampscott and Nahant with pure drinking water. The flavor and purity of this water is greatly superior to that now in use, and much of it, drawn from springs in the neighborhood, is sold by vendors in those towns and in the city of Lynn. The construction of this water tower requires about eighty tons of steam-boiler plates and rivets, there being 14,000 of the latter to hold the plating together. When complete it will hold 324,000 gallons of water, which will approximate 1,300 tons. The iron work is under the direction of Thomas R. Keenan of South Boston, for the R. F. Hawkins Iron Works, Springfield, Mass. This reservoir, when complete, will be the most prominent landmark on the coast in this vicinity. It is now rapidly approaching completion.

HANNIBAL, MO., PUMPING ENGINES.—The contract trial of the new pumping engine recently put in by the Water Company was made November 5, with results which are highly satisfactory to both the company and the builders of the machinery. The contract requirements, both as to quantity of water pumped, and economy of steam, were greatly exceeded by the actual performance of the engine during the practical every day trial under which the engine was tested. The trial was conducted by J. H Decker, superintendent of the Water Company, and Caarles A. Hague, representative of Edw. P. Allis & Co., of Milwaukee, the manufacturers of the engine.

The engine is rated at a capacity of two and a half million gallons of water in 24 hours, at a plunger speed of 150 feet per minute. It is of the compound condensing type, known as the Reynolds-Corliss, with one high pressure cylinder, 23 inches diameter; one low pressure cylinder, 45 inches diameter, and two plunger pumps 17 inches diameter, all of 30 inches stroke. The engine weighs complete about 100 tons, is very handsomely finished, and presents a massive, substantial appearance; one of the first requirements of a pumping engine being the ability to pump water under any and all conditions with the minimum of wear and tear. This quality is most eloquently set forth by the design and general make-up of this engine.

The great aim of the present day in pumping engines, in conjunction with the utmost durability, is the highest possible economy of coal, and in this particular the new machinery of the Hannibal Water Company is second to none in the country; the result of yesterday's trial demonstrating the extreme economy in steam effected by the Reynolds type of compound pumping engine, as will be shown by the following record of the test:

Water pumped per hour—117,794 gallons.
Coal burned per hour upon a basis of 10 pounds evaporation—207 pounds.
Head pumped against, including friction—218 feet.
Revolutions of engine per minute—33.
Steam pressure—79 pounds.
Receiver pressure—7 pounds.
Vacuum—26 inches.
Pounds of water raised one foot high with the consumption of each hundred pounds of coal—118,327,035.

With the extreme refinements usually practiced in expert trials, the duty would be increased to over 125,000,000.

The city of Hannibal is to be congratulated upon the acquirement of one of the best of modern pumping engines, most effectually guaranteeing it against a water famine.—Hannibal *Journal*.

OIL IN THE BIG HORN BASIN.—LANDER, WYO., Nov. 12th.—A spring of almost pure petroleum has just been found in the timberless district of the Big Horn basin. For more than a year past expectation in our oil circles has been on tiptoe in regard to the oil developments of the Big Horn country. To-day sees these expectations far more than realized. The spring just discovered is phenomenal. Along the base of a high bank there stretches for 150 yards continuous oil fountains—not the muddy, crude stuff usually submitted to the refiners from the oil wells, but oil itself—pure, smooth and glistening. Beneath the surface of the ground there seems to be a huge natural refinery in active operation. So pure is the oil as it wells forth that a quantity of it poured upon any hard, smooth substance can be converted into a clear, steady flame by the touch of a match. The fountains are prolific, sending forth full and steady streams. All along the line of output the oil can be dipped up at the rate of a quart per minute. A flattering peculiarity is that it has apparently no residuum. The soil over which it flows shows no deposit of baser ingredients. Asphalt itself, so common as a residuum in all the hitherto

found petroleum of this region, is not to be seen. In the employ of Messrs. Conant & Anton, the lucky discoverers and locators, was an old oil expert who has spent years in the petroleum fields of Pennsylvania. He says his experience has failed to prepare him for any such sight, and values the fountains as they stand at $100,000. The owners have given their new discovery the name of "The Bonanza Oil Springs." The locality in which they are situated, some 150 miles due north of this point, owing to promising indications, has lately been the great attraction of oil men, and it is now said that these same indications point to the existence of other springs in the same district, even larger and more valuable than those already conferring a fortune upon the lucky finders.

Day by day is demonstrated the fact that beneath the surface of the Big Horn basin lay exhaustless hoards of coal and petroleum. Rich developments are but questions of short time, and soon capital's stream will flood the now waste places and reap therefrom a golden harvest.—*Chicago Tribune.*

WAUSAU, November 13.—The contract test of the Wausau water-works took place to-day. The first test, ten streams, fell a little short of 100 feet, the required height, the average being 89 feet. An exhibition test of fifteen streams averaged 88 feet high. A stream through 1,200 feet of hose was thrown 70 feet high and 105 feet horizontally. The Council Committee have not made their report, and it is not yet known whether the work will be accepted or not. Except for a strong wind, it is believed the water would have reached the contract height. The works were put in by the Holly Manufacturing Company, and have a daily capacity of 6,000,000 gallons. Ninety-one hydrants and eleven miles of pipe furnish ample fire protection.—*Milwaukee Sentinel.*

NEWS OF THE WEEK.

Contracting.

New Court House.—Toledo, Cumberland Co., Ills., wants plans for a new court-house to replace the one destroyed by a cyclone, Nov. 4.

A New Steamer for the Sound.—A contract has been made with Messrs. Montgomery & Howard of Chelsea, to build for the Old Colony Steamboat Company, a large side-wheel steamer. She is to be 280 feet long, forty-two feet width of hull and seventy-three wide over all, and eighteen feet six inches depth, and is to be ready for service next June.

The Lake Shore road has decided to build a line from Jamestown to the Allegheny Valley road near Falconers, the road being organized under the name of the Jamestown & Northeastern. The road will be a part of the Dunkirk, Allegheny Valley & Pittsburg, and is to be finished by June 1st. next. Work will be begun on a depot at Jamestown and on three iron bridges at an early day.—*Buffalo Express.*

Corbin's American Steamship Plans.—The project for the establishment of a line of fast steamers between Fort Pond Bay, L. I., and a point on the west coast of Ireland, is being actively pushed by President Corbin and the directors of the Long Island Railroad. Plans are being prepared for steamers of 7,000 tons, to cost $1,500,000 each. A petition has been prepared to be presented to Congress during the coming session, asking a subsidy for carrying the mails. It is proposed to have the line a strictly American one in every respect, the vessels to be constructed in American yards.

The Railroad to Hudson Bay.—Ottawa, Nov. 16.—A party will start soon to make a survey of the proposed route of the Hudson Bay Railway from Lake Winnipeg to the head of tidal navigation on Nelson River, a point about sixty miles above Port Nelson. Should the survey prove, as the projectors say, that there are no engineering difficulties in the way in this part of the route, English capital is ready for its construction, and work may be commenced next spring. The contractor says that he is prepared to construct this portion of the road in one year, and to commence any time he has instructions and the necessary guarantee.

Public Building.—The following is an abstract of the bids on stone work for the public building at Pittsburg:

Bodwell Granite Company, $416,164, Fox Island stone.

W. D. Collingwood, $220,000, Berea.

Shreiner & Cochran, $502,263, Stinesville, Ind. limestone: $379,170 blue malone; $370,170 buff Amherst and $360,170 for blue Amherst.

A. Dall, Jr., $249,177 buff Amherst; $229,177 blue Amherst.

Gill & McMahon, $438,713 Watersville granite.

W. R. & W. Haven, $277,407, Bedford; $260,228, buff Amherst; $239,070, blue Amherst; $231,515, Berea; $312,400, Brown stone.

M. A. McGowan, $261,307, Berea; $262,259, Indiana; $278,548, Amherst; $374,972, Block Island.

David Tillson, $379,000, Hurricane.

Booth & Flynn, $218,000, Berea; $259,788, blue Amherst; $272,787, buff Amherst; $306,913, Bedford.

Hallowell Granite Company, $288,573, Bedford.

State Reformatory.—The contract for the Kansas State Reform School at Hutchinson, Kan., was awarded on the 13th to the firm of Evans & Bricker, of this city, the bids being as follows: R. T. Durkee, $58,000; Theo. Lescher, $47,933; Wm. Tweeddale, $47,000; Henry Bennett, $41,635; James Cuthbert, $38,182; Evans & Bricker, $37,183. The building is to be 184x46 feet and 40 feet high; two stories without basement. The amount of the appropriation for the stone-work, iron-work, windows and roof is $6,000. The building must be completed by August 15, 1886, and will afford accommodations for 200 prisoners. The State has 640 acres of land, purchased by the people of Hutchinson at a cost of $25,000, and donated for the purpose.

The New York Ferry Company.—A certificate of incorporation of the Brooklyn and New York Ferry Company has been filed.

Railroads, Bridges and Canals.

The Indiana Midland Railroad Company has decided to push their road on west of Lebanon, Ind.

Highway Bridge.—The Highway Commissioners, near Fisher, Ills., are erecting an iron highway bridge.

Highway Bridge.—Greenup, Cumberland Co., Ills. has voted to build a highway bridge across the Embarrass river, a little north of that place.

The U. S. Engineers have just completed the surveys for proposed river improvements in the neighborhood of Portage, Wis.

New Bridge.—The supervisors of Plattsburgh, N. Y., have granted authority to raise $10,000 to build an iron bridge over the Saranac on Bridge street. The bonds are to be paid in $2,000 instalments annually, commencing March 1, 1887.

The Savannah, Dublin and Western Short Line Railway Company, extending from Savannah to Macon, Ga., with a branch from Dublin to Americus, Ga. has recently been organized, with a capital of $2,000,000. Grading has already commenced.

Brooklyn Elevated.—Without ceremony and without delay the Brooklyn Elevated commenced running its trains through to Fulton Ferry at exactly twelve o'clock, Nov. 10, in accordance with the official programme.

Another Transcontinental R. R.—The completion of the through line of the Atchison, Topeka & Santa Fe railway system to the Pacific ocean was celebrated at San Diego, Cal., on the 18th inst.

Lookout Mt. R. R.—Eight hundred feet of the Lookout Moutain Railroad at Chattanooga has been graded and made ready for the rails. The total length of the road will be 4,200 feet.—*Augusta Chronicle.*

Coal Breaker.—The Bloomington, Ills., coal company are just completing a coal breaker; probably the first soft coal breaker in the country, and certainly the first in Illinois coal fields.

Memphis & Charleston R. R.—A dispatch to the Chattanooga *Times* from Huntsville, Ala., says that the stockholders of the Memphis and Charleston Railroad have decided to issue additional stock, amounting to $2,250,000, to pay off certain indebtedness and build the line from Stevenson, Ala., to Chattanooga, a distance of forty miles.

St. Louis & San Francisco R. R.—Jas. Dunn and G. F. Huggans, Chief and Assistant Engineers of the St. Louis and San Francisco Railroad, started west from Red Fork, I. T., Nov. 10, to complete the survey of the line from that point southwest, 100 miles, the construction of which is to commence at once. This extension will put the road into the Oklahoma country, the result of which may be surmised.

New R. R.—A company was organized at Ninety-Six S. C., November 13th, to build a narrow gauge railroad from Greenville to Johnsons, in Edgefield County, S. C., with the intention ultimately of extending the line to Charleston or some other point on the South Atlantic coast. Enough money has already been subscribed to grade the line. H. P. Hammett, of Greenville, S. C., was elected President.

Del. & Hud. Canal Co.—There is some probability of the abandonment of the Delaware and Hudson Canal in favor of a railway track to be laid along its bed. The Canal Co., has made affidavit to the Assessors of the Rondout end of the canal, that the canal is a burden and "does not pay running expenses." The canal cost $6,500,000, has been in operation since 1829, and fifteen years ago paid 140 per cent. premium, the stock selling at $240 a share.

James River Valley R. R.—Work on the James River Valley R. R. has been slightly delayed owing to a lack of steel, but is now being rapidly pushed to completion. Only 12 miles remained to be laid, November 9th, and connections from the Jamestown and La Moure divisions were made November 14th. Of the 36 miles already laid, most of it is ready for the ballast, and it is now expected to have everything ready for the operating department by December 1st.

Wheat by Rail from Manitoba.—MONTREAL, Nov. 18.—Last night a special train of 21 cars of wheat arrived here from Ogilvie & Co., from Manitoba, being the first arrival of grain over the Canadian Pacific Railroad from the West. The train was made up at Verdun, Manitoba, and made the run from Winnipeg in five and half days.

Road Graveling.—Paris, Ills., has just completed the graveling of fifteen miles of a public highway lead ing out from that city. An additional five miles is contemplated, that being the remaining link to connect that city with Clinton. The work has been done under the direction of the Road Commissioners with money raised by taxation.

Another Through Line.—SAN DIEGO, Cal., Nov. 18.—This city was crowded with visitors to-day who had come to take part in celebrating the completion of the Southern California Railroad. This route now gives the Atchison, Topeka and Sante Fe system a through transcontinental line to the Pacific coast.

A New Railroad.—YOUNGSTOWN, O., November 14th.—The survey has been completed for the Youngstown & State Line Railroad, and petitions have been filed in Probate Court to appropriate certain land in the city for railroad purposes. The line, which will be built by the Pennsylvania Company, will intersect the Ashtabula & Pittsburg Railroad here, then, running northeasterly, strike the Erie & Pittsburg Railroad at Wheatland, Pa. The purpose in building the line is to secure a short cut for freight from Erie to the Mahoning valley and via the Alliance, Niles & Ashtabula Railroad to Alliance.—Pittsburg *Commercial Gazette.*

THE Brooklyn water-works are to be extended ten miles further east, as far as Massapequa Pond. It appears from the report that the scheme embraces a reservoir half mile long, covering more than seventy acres, and with a capacity of 400,000,000 gallons; a 48-inch force main a mile and a quarter in length; a 30-inch pipe extending a distance of three miles; a conduit nine feet in diameter capable of carrying 60,000,000 gallons a day, and pumping engines of a daily measure of 10,000,000 gallons. The extension will take in five new streams and its product will be an addition of 20,000,000 gallons every twenty-four hours to the quantity of water distributed throughout the city. The work, energetically pushed, will need several years to finish.

Canadian Pacific Plans.—TORONTO, Nov. 18.—A special to the *Globe* from Ottawa says: "It is authoritively stated that at the coming session of Parliament the Canadian Pacific Railway Company will ask for further public aid to enable them to consolidate and develop the whole railway system of the maritime provinces. They are anxious to secure contracts for the construction of all railways that have been subsidized by the Dominion Government, their aim being to monopolize the control of the Canadian railway lines east of Montreal. The Government will hand over to the Canadian Pacific Company without charge that portion of the Intercolonial Railway between St. John and Halifax, and the company will ask for a subsidy of $10,000,000 to enable them to buy up the railways owned by other corporations in Nova Scotia and New Brunswick, as well as to build connecting links.

Kentucky and Indiana Bridge.—The Indiana approach to the bridge is rapidly approaching completion. Most of the heavy superstructure for the railroad track is in position, and the balance will be placed very shortly. The wrought-iron and steel for the great structure are arriving in large quantities, and all the material required in construction is being promptly furnished by the contractors. The Bridge Company is doing what few construction companies in this country have done—paying for its material and the estimates of its contractors promptly to the moment. No debts are allowed to accumulate, and when the bridge is completed it will be paid for, with not a dollar of construction indebtedness upon it. The contractors say they will certainly have the bridge completed within the contract time.

A good deal of inquiry is being made for the bonds and stock of the company. The bonds of the company are first mortgage, and aggregate but $1,000,000. No additional bonded debt can be placed upon the property. The bonds bear 5 per cent. interest, and the first maturity of interest on them fell in September and was promptly met, and provision has been made to meet as promptly the interest on these bonds until the bridge is opened and begins to earn its own interest.

There is the same amount of stock as of bonds. Sales of bonds have been made at from 92 cents to par. The stock is not purchasable, as it is in the hands of those who have secured it as an investment, and who are confident it will be worth $1.25 on the dollar within the next two years.

The bridge will have a track for railroads, two tracks for vehicles and street-cars and two tracks for foot-passengers. Its approach on the Indiana side will be from Main street at East Fourteenth, out Fourteenth to Dewey, and east on Dewey to the bridge track. When completed the structure will be the finest one of its kind over the Ohio river.—Louisville *Courier-Journal.*

The Long Island Railroad Company is considering an extension and alteration of its North Shore divisions. The scheme is to extend the line from Great Neck to Roslyn, connecting at the latter place with the line to Glen Cove and Locust Valley. From this last named place the line is to be carried through to Oyster Bay and Cold Spring. It will be necessary to build eighteen miles of road.

South Carolina R. R.—The seventh annual report of the South Carolina Railroad Commissioners, covering the fiscal years 1884-85, states that although the depression in business has been so great during the past year, eight railroads have reported an increase in earnings over 1884, and ten show only a slight decrease. At the same time more miles of new road have been constructed during the last year than in any other for a decade, 103¾ miles of new road having been built in the State and ten miles on the Spartanburg and Asheville Road, which, although in North Carolina, is of the greatest importance to South Carolina.

Memphis and Charleston Extension.—In an interview with Samuel Thomas, President of the East Tennessee, Virginia & Georgia system, a *Times* reporter asked for definite information regarding the proposed extension. Mr. Thomas replied: "I am indeed sorry that I cannot. The company realized that the road must be extended to Chattanooga, so we concluded to authorize the issue of bonds with which to do the work. I am not able to say when the work will be commenced. Yes, the route has been discussed and that is all. There are two routes from Stevenson—one on the north and one on the south side of the river, but as to which will be chosen I cannot say. I can assure you of one thing, the extention will certainly be built." —Chattanooga *Daily Times*.

The St. Louis, Carbondale, Metropolis and Paducah Railway Company, incorporated on the 14th. It is proposed to construct the railway from St. Louis, Mo., to Paducah, Ky., running from East St. Louis through the counties of St. Clair, Monroe, Washington, Randolph, Perry, Jackson, Franklin, Williamson, Union, Johnson, and Massac, in Illinois, to a point opposite Paducah, Ky., on the Ohio River, and passing near the cities of Vienna and Metropolis, in Illinois. The capital stock is to be $2,000,000, and the incorporators are James Millan and Charles H. Appell, of St. Louis; H. W. Hart, W. E. Smith, and L. A. Bosworth, of Alton. The principal office is to be at East St. Louis.

The Atlantic & Great Western (N. G.).—The new line is to run from Johnston's on the Charlotte, Columbia and Augusta Road, to Fruit Hill, Ninety-Six, Coranaca, Stoney Point, Cokesbury, Triangle, Ware's Shoals, Lickville, in Greenville County, Pelzer, Piedmont and Greenville in South Carolina. H. P. Hammett, President of the Piedmont and Camperdown Cotton Mills is President; and W. J. Kirk, Vice President and Chief Engineer. The Directors elected are: E. A. Smyth, President of the Pelzer Cotton Mills, James McCullough, of Greenville; Dr. T. W. Chiles, of Edgefield; G. T. Jackson, of Ninety-Six; W. Scott Allen, of Fruit Hill; F. A. Connor, of Cokesbury; W. J. Hewitt, of Johnston's; L. M. Moore, of Ninety-Six; J. B. Humbert of Laurens. F. M. Pope of Ninety-Six is Secretary and Treasurer. The Executive Committee are T. W. Chiles, G. T. Jackson and F. A. Connor. Subscriptions amounting to $61,000 have already been made, and Chief Engineer Kirk states that there is enough money to grade from Johnston's to Greenville. The company operates under the charter of the Greenville and Port Royal R. R. Co., passed several years ago. The Secretary can be addressed at Ninety-Six, S. C.

The Nicaraguan Canal.—WASHINGTON, November 14.—The report of Civil Engineer Menocal, United States Navy, upon the Nicaraguan Canal route recently surveyed by a party of which he was at the head has been made public. The proposed route extends from the harbor of Greytown, on the Caribbean Sea, to Brito, on the Pacific. Its total length is 169.8 miles, of which 38.98 miles will be excavated canal and 130.82 miles navigation by Lake Nicaragua, the river San Juan, the basin of the river San Francisco, and seven locks. The eastern division, nineteen and one-half miles in length, comprises 63 per cent. of the total excavation of the entire canal. This portion of the line is upon an entirely new location, beginning at the southern extremity of the proposed inland lake. In the San Francisco valley the canal runs nearly due east through a broad, flat valley, a distance of about 1,600 feet, the average elevation being 125 feet above the sea level, or 19.13 feet above the level of the canal. Thence across projecting spurs the divide is reached at an elevation of 280 feet in a distance of 4,600 feet from the basin of the San Francisco. The line then curves with a radius of 10,733 feet for a distance of 2,800 feet across the little plain at the summit, cuts a steep narrow spur, enters the valley of a stream called Deseado, the bed of which it follows a short distance, then crosses to the left bank of that stream and reaches the site of lock No. 3 in a rocky spur of the northern hills, 14,200 feet distant from the canal level on the other side, the average depth of cut for this distance being 119.5 feet above the water in the canal. It is estimated that the canal can be completed in six years, and will cost, including a contingent of 25 per cent. added, $64,043,697.

The Union Pacific is about building an important little link of less than forty miles, called the Manhattan & Blue Valley Railroad, which will connect its Kansas Pacific line with the main line in Nebraska.

The Cautious German.—The *National Zeitung*, Berlin Nov. 10, advises that experts be sent to report on Stanley's Congo Railway scheme before German money is invested in it. The *Norddeutsche Allgemeine Zeitung* urges Germans to forestall Americans in Chinese contracts in preference to Stanley's scheme.

New Alpine R. R.—A proposal has been made to construct another Alpine railway between Chur and Biasca, and thus provide another link between the railways north and south of the Alps. The project would necessitate the piercing of the Luckmanier chain, which extends between the Upper Rhine valley and the basin of the Lake of Tessin or Langensee, but which is not expected to offer any serious engineering difficulties. The railway will have to cross only one watershed, that of the Luckmanier, without having to surmount, as in the case of other Alpine railways, secondary watersheds. The length of railway to be constructed, and joining Chur and Biasca, would be sixty-one miles. Its cost is estimated at about $25,000,000, of which between $15,000,000 and $17,500,000 would have to be expended upon the construction of a tunnel through the Luckmanier chain, thirteen miles long, between Surheim, near Dissentis, and Olivone near Biasca. The countries most interested in the construction of the new railway and tunnel are, beside Switzerland and Italy, Bavaria and Central and Eastern Germany. If completed, the Luckmanier Railway would to some extent supersede the St. Gothard Railway.

Ohio Valley R. R.—A company has been formed, composed mostly of Pittsburg capitalists, for the purpose of building a railroad across the State of Kentucky into Tennessee. The largest stockholder in the proposed enterprise is Capt. Sam S. Brown, of W. H. Brown's Sons, coal operators. He has engaged to build fifty miles of the road at his own expense. Some time ago Capt. Brown purchased a tract of valuable coal lands, consisting of over 2,000 acres, near Dekoven, Union County, Ky. The line of the proposed road was surveyed from Evansville, Ind., down through Dekoven to Jackson, Tenn. It is to be called the Ohio Valley Railroad. It extends in a southwesterly direction, and opens up a portion of country the richest in minerals and agricultural products of any part of the State. "The engineer estimates that the entire line can be built for $2,000,000," said Mr. Brown. "The grading is easily done, and there are no cuts of any consequence. The country is a good one for local traffic, and, aside from the coal shipments, the road will pay. The people of the towns through which the road will pass are very much alive to the successful termination of the project. The coal supply of the Dekoven district is practically inexhaustible."

Cost of Change of Gauge.—The annual report of the Mobile and Ohio Railroad Company gives the following account of the change of gauge of that road (527 miles in all) from 5 feet to 4 feet 8½ inches, made in July last:

"The Cairo extension was changed about a week before the day fixed for the general change, in order to test the plans and arrangements for the work, and also because of the large proportions of trestle work on that part of the road. Sufficient standard gauge equipment was sent from the Jackson shops to East Cairo via the Illinois Central Road to operate this twenty-one miles temporarily.

"The track between Mobile and Columbus, Ky., a distance of 472 miles, was changed on July 8—all of the rolling stock having been sent down the night previous and placed on the side tracks at the several shops (for which purpose and the storage of cars already changed over twelve miles of temporary siding had been provided), and at the same time a large proportion of the sidings were changed. The branches to Columbus, Aberdeen and Starkville, Miss., were changed on July 9.

"The freight traffic was suspended from the 6th. The passenger train which left Mobile at 9:30 P. M. on the 7th was discontinued at Macon (200 miles north of Mobile) the next morning, and the south-bound passenger train which should have left Cairo on the morning of the 8th was omitted entirely.

"The regular trains left Mobile and Cairo on the evening of the 8th, and since then the movement of trains has been without accident or detention of any kind that could be attributed to the change of either the rolling stock or the track.

"The labor required to move the rail and to make the track safe for the passage of trains was 1,873 days, or 3,554 days' labor per mile of main line and branches. This labor was paid $1.50 per day, making the cost of moving the rail $2,809.75, or $5.33 per mile, which with $15.87 per mile for drawing and resetting spikes, adzing crossties, etc., before the change and $6.79 per mile for regauging and spiking after the change, made the total cost $27.99 per mile of road and branches. * * *

"It was estimated that the cost of changing the track and equipment, including preliminary work and material, would amount to $95,777. It will probably, however, be completed for less than $80,000."

Vermont's First Street Railway.—The street car line at Burlington, Vt., was opened Nov. 13. This is the first street railway in the State.

Illionis Drainage.—The "Mason and Tazwell" ditch, between Pekin and Havana, Ills., including branches, is thirty-one miles long; the cross-section area varies from 300 to 250 square feet. It is now nearly completed, and has cost about $225,000. The work was done by a dredge. Price 15c. per cubic yard. D. C. White, Forest City, Mason Co., is Commissioner.

Work on the big ditch south of Homer, Ills., has been suspended on account of too much water; as the work is being done with scrapers, it is not expected to resume again until late next summer. The present contractor, C. W. Halloway, of Farmer City, Ills., has completed only three-fourth of a mile of his seven-mile contract. It is contemplated extending the ditch still further. E. N. Raynor, of Homer, has the matter in charge.

The Point Pleasant Bridge.—The last of the iron on the railroad bridge at Point Pleasant, W. Va., was placed in position on the 12th. The following dimensions of the bridge were furnished by Colonel Seymour, the chief engineer: Length of West Virginia iron trestle approaches 1,514.52 feet; length of iron truss bridge span No. 1, 248.23; length of iron truss bridge span No. 2, 250.84; length of iron truss bridge span No. 3, 250.83; length of iron truss bridge span No. 4, 420; length of iron bridge span No. 5, 200; total, 1,370; Ohio iron trestle approaches, Ohio side, 1,062; total length of bridge, 4,628.30, being a fraction less than one mile. The total weight of the bridge and approaches is 3,272,628 pounds. Total cost of bridge, $600,000.

Newport Street R. R.—A charter has been obtained for a street railway in Newport, R. I., and the privilege of laying tracks asked of the City Council. Some twenty-five New York and Boston millionaires, whose real estate there is valued at more than $37,000,000, have signed a protest against the railway, which, they believe, will be detrimental to the best interests of the city. Many of them threaten to sell out and move. The newspapers and most of the citizens favor the road. The City Council will hold a meeting immediately, with a view of submitting the question to the voters at large. Some of the owners of carriages have already notified business men on certain thoroughfares that if the rails are laid they will not drive over the streets, and therefore the shops will lose their trade.

Miscellaneous.

The Navy's Hydrographic Work.—WASHINGTON, Nov. 12th.—The annual report of the operations of the Hydrographic Office, made by Commander Bartlett, its chief, to the Chief of the Bureau of Navigation, is given to the press by the Secretary of the Navy today. The Hydrographic Office, Commander Bartlett says, is the only establishment on this continent which produces charts of foreign waters, and it should be provided with sufficient means to be able to furnish them, covering any portion of the navigable waters of the globe at very short notice. Owing to the changes constantly taking place in the earth's surface, and to the fact that many portions of the globe are very imperfectly surveyed, it is necessary to issue new editions of charts as fast as new information is obtained. An imperfect chart is a danger rather than an aid to navigation, as it induces overconfidence in dangerous localities. The means should, therefore, be at hand for correcting the charts at once, so that the merchant marine will not be under the necessity of using defective editions. The sale of the publications of the Hydrographic Office, all of which are aids to navigation, continues to increase in a satisfactory manner. Much matter that was formerly considered necessary has been dropped or embodied in labels for easy reference and the necessary features have been rendered more conspicuous, the aim being to make a simple, plain, practical guide for seamen, who, from the circumstances of their profession, are rarely in condition and have not the time to make a very close study of the chart when the moment comes to use it. The pilot chart has received a wide circulation through the influence of the branch hydrographic office. The Hydrographer says also that there has been a great demand for this chart by transatlantic voyagers as well as by seamen, and that where ships have got into difficulty by reason of going too far into the floating ice regions, the newspapers have pretty generally called attention to the culpability of such a course, as the pilot chart has always indicated a safe route.

The value of the use of oil to smooth the breaking seas during gales of wind has been widely discussed, and the accounts of different experiences published monthly on the pilot chart has been exceedingly interesting. Many who could not understand how a film of oil could be efficacious under such circumstances have been convinced of the fact that it is of valuable assistance during heavy gales. The dissemination of the reports of shipmasters who have owed the safety of their lives and cargoes to this agent have become too numerous and are too unanimous to be disregarded by the most conservative.

LAST WEEK, Nov. 11th, Chemical National Bank stock sold at auction at $2,710 per share—par value being $100. At the same time and place 20 shares Marine National Bank stock sold for just $3.00.

Kansas City's New Exchange.—Articles incorporating the Exchange Building Association of Kansas City for the purpose of erecting the new board of trade building were filed November 10th. Capital $208,000 half paid up.

Experimenting With Pendulums.—ITHACA, N. Y., Nov. 13th.—A party from the United States Coast and Geodetic Survey has arrived here to make experimental researches with pendulums. A station will be situated on the Cornell University grounds. The party will remain here several weeks.

Surveying the South Shore.—HINGHAM, November 10th.—C. H. Van Orden, James B. Tolley and David W. Lane of the United States coast survey have been engaged the last four weeks in taking a survey of the coast from Hingham to Scituate. More recently Lawrence Thompson and Clifford Arrick of Washington, of the United States Geological Survey have been engaged in a survey of the interior of the same district.

Enlarging the Work of the Geological Survey in Louisiana.—WASHINGTON, Nov. 9th.—Prof. Willis and Mr. Burns, scientists of the Bureau of Geological Survey, will soon start for Louisiana to extend and enlarge the operations of the department in Louisiana. They are for the moment engaged in finishing up some work in Virginia, and will go south immediately upon its completion.

An Economical Fuel.—A party of engineers, capitalists and manufacturers visited the pumping station of the Salem Water Works at North Beverly, November 12th, to witness the performance of a new method of making steam by petroleum combustion. It was found that the apparatus, which had been in operation for several months, was producing a saving of nearly 30 per cent., as five barrels of crude oil produced better results than three and a half tons of the best coal.

Paving Block.—A new style of paving block is composed of a hollow iron shell filled with any desired concrete, the shells being arched underneath, and for street paving are 4 inches wide and from 10 to 12 inches long. The blocks, or filled shells, are laid against each other upon the prepared roadbed, and the form of the bottom compacts the sand underneath, making the whole structure very firm and solid. The surface of a street paved with these blocks would be about as smooth as if paved with asphalt.

Gravel Roads.—Princeton, Ill., has spent about $4,000 annually for several years in graveling the highways, and now the principal roads of the township are affected by neither frost nor rain. About 10 feet of the roadway was covered 6 to 8 inches deep. They were fortunate in having plenty of good gravel easily accessible. One who has never lived upon those rich western prairies cannot appreciate the need of such improvements. The township will spend $8,000 on the roads next year.

Geological Survey.—Vol. I of the final report of *the Geological and Natural History Survey of Minnesota*, contains interesting and very valuable matter, particularly to engineers in that part of the country, concerning the building stones of Minnesota. The State seems to be supplied with building stones second in quality and quantity to no other State. The report, a quarto of 700 pages, with many photo-lithographs and engravings, is the most handsomely printed, and best bound of any geological report we have seen. Prof. N. H. Winchell is director of the survey.

To Drain the Valley of Mexico.—CITY OF MEXICO, Nov. 11th.—President Diaz, accompanied by the ministers of the treasury, public works and interior, has made a visit of inspection along the route of the proposed sewer for draining the valley of Mexico. The plans involve the construction of a canal from Lake Texcoco to Lake Zumpango; thence the water is to pass through a tunnel five and a half miles long. The estimated cost of the work is $4,000,000. Local sanitary authorities estimate that the drainage of the valley will result in reducing the death rate one-half.—*Rochester Democrat-Chronicle.*

European Canal Projects.—Two great Continental canal projects seem to have arrived at a stage of action. Germany is ready to vote 155,000,000 marks for a ship canal connecting the Baltic with the Elbe and the German Ocean, the entrance on the Baltic being Holtenau and the other entrance being Brunsbüttel. The work will have an immense commercial value, as over $5,000 000 tons are certain of transportation annually, while ships now go around Denmark with a yearly loss of 200 vessels off Cape Skagen. The military importance is scarcely less, for it will prevent the danger of a Baltic blockade. Heligoland will command the western entrance of the canal and will be heavily fortified. Count von Moltke, who has heretofore opposed the scheme, now commends it. The other project is for a canal to make Bruges a seaport, and the Belgian Government is preparing to give a concession of the preliminary work at Heyst to an English syndicate. The ob will cost $5,000,000.

Street Railroad.—Meriden, Conn., is desirous of having a street railroad.

D. & H. C. Railway Co.—Work on the branch of the Delaware and Hudson Railroad to Stillwater is progressing rapidly. Over a mile of the track is laid.

Breakwater.—A New Haven wants an appropriation from the general government of $600,000 to establish a breakwater in the horbor, and Congressman Mitchell is to exert himself to gain that snm.

Another Eads Railway Scheme.—JACKSONVILLE, Fla., Nov. 19.—Francis J. LeBaron, civil engineer, will start to-morrow with a full corps of assistants to make a preliminary survey across the peninsula of Florida for Captain Eads' contemplated ship railway. Captain Eads writes that he has the matter of constructing a ship canal across the peninsula of Florida under investigation, and is convinced of its practicability.—Philadelphia *Press.*

English Experiments in telephoning between a lightship and the land have proved remarkably successful. The vessel selected was anchored 10 miles from shore in 60 feet of water. For eight months messages of all sorts have been sent and received in all weathers, with but a single interruption from a break in the cable. Passing vessels have been signalled and reported; orders transmitted from owners to their ships approaching or leaving port; the state of wind and tide communicated to waiting mariners, and timely notice given of the occurrence and location of wrecks.

Recent Patents.

Asphaltic Mastic.—*A. L. Barber Washington, D. C.* Includes a block, a mastic, and a paving composition composed of pulverized limestone, refined Trinadad asphalt and residuum of petroleum in certain proportions; in the paving composition gravel is also used. An asphaltic cement for paving and roofing is composed of hard asphalt combined with a naturally liquid or soft aphalt, mixed with sand. Nos. 330, 196; 330, 197.

Engineer's Reversible Level.—*C. F. and Thos. Cooke, York, England.* The telescope is held in a tubular socket with collars which are attached to the base piece, one of which collars is vertically adjustable, the other turning on a pivot. No. 330, 210.

Market Report of Engineering Materials.

New York, November 19, 1885.

NOTE.—The following Market Report gives wholesale prices on the New York Market unless otherwise stated. It is intended as a general guide to the estimating engineer. We give it with this caution, that, as is well understood in business transactions, the amount of bill, distance from market centre and conditions of payment will have a material influence on the final paying prices.

IRON.

STRUCTURAL IRON.			
Angles	1.95	@	2.05
Tee	2.2	@	2.4c.
Beams and channels American	3.0c.	@	
Tank	2.	@	2.1c
Shell	2.4c.	@	2.5c
Steel plates, Tank	2¼c.	@	3c.
WROUGHT-IRON PIPE.. PITTSBURGH.			
Butt welded, black ..Discount	42½	@	45
" galvanized "	32½	@	35
Lap welded black	60	@	62½
" Galvanized "	45	@	42½
Boiler tubes	57½		
RAILS.			
Steel (large lots at mill)	32.00	@	35.00
Old rails	18.25		
Old railsteel	18.00	@	19.00
R R. spikes	.02		
R. R. splice-plates	1.75		
R R. Track Bolts Square Nuts	2.75		
Barb-wire fencing, galvanized			4.50
" painted			3.50
Corrugated iron			
Nails			
Iron, per keg	3.25		
Steel do.	3.35		

METALS.

COPPER.			
Lake Superior	11	@	11¼
Other Brands	10	@	10½
LEAD.			
Com. Domestic	4.20	@	4.25
Lead Pipe	.05¾		
Tin-Lined Lead Pipe	.15		
Sheet Lead	.06¾		
ZINC.			
Sheet	5.70	@	5.90

BRICK.

Cargoes afloat)			
Haverstraw per M.	$5.75	@	6.25
Fishkill			
Up-River	5.50	@	6.12½
Jerseys	5.00	@	5.75
Long Island			
" pale	3.50	@	3.75
FRONTS.			
Croton red	11.00	@	14.00
" dark	11.00	@	14.00
" brown	10.00	@	13.00
Philadelphia pressed	24.00	@	25.00
Trenton "	24.00	@	25.00
Baltimore "	37.00	@	41.00
Buff "	33.00	@	35.00
Enameled English	65.00	@	130.00
" American	85.00	@	120.00
Fire brick	25.00	@	40.00

CEMENT.

The following price current is made up entirely from quotations furnished us directly by the firms dealing in each brand; the prices are understood to be wholesale in New York, subject to such special rates as large quantities may warrant:

BAETJER & MEYERSTEIN:			
Hanover Portland	$2.60	@	$2.65
BELLONI & Co.:			
Hemmoor "Crown" brand			2.50
JAMES BRAND:			
K. B. & S.	2.55	@	3.00
BROOKS, SHOBRIDGE & Co.,	2.55	@	2.60
HOWARD FLEMING:			
Gibbs' English Portland, 400 lbs.	2.65	@	2.90
K. B. & S. " "	2.75	@	2.95
Stettiner. German	2.65	@	2.85
Lagerdorfer, "	2.45	@	2.75
Fieve, A 1, Belgian	2.35	@	2.50
Roman	2.75	@	3.00
Keene's Coarse	4.75	@	5.50
" Fine	7.75	@	8.50
" Superfine	8.50	@	10.00
FISHER, EBSKINE W.:			
Stettin (German) Portland Cement	$2.40	@	2.75
GABRIEL & SCHALL:			
Vorwohler "Lion"	2.65	@	3.10
HUDSON RIVER CEMENT Co. Rosendale			1.10
JOHNSON & WILSON:			
Saylor's American Portland	2.15	@	2.40
LAWRENCE CEMENT Co.:			
Hoffman Rosendale			
LESLEY & TRINKLE, Philadelphia, Pa.:			
"Giant" Portland	2.20	@	2.40
Improved "Union"	1.25	@	1.50
Union	1.10	@	1.20
MARCIAL & Co.:			
J. B. White & Bros. Coarse	4.50	@	5.00
" Fine	8.00	@	10.00
" Portland	2.45	@	2.85
NEW YORK CEMENT Co.:			
Rosendale			1.20
N. Y. & ROSENDALE CEMENT Co.:			
Rosendale, "Bridge" brand			1.10
SINCLAIR & BABSON:			
Alsen's Portland	2.45	@	2.75
STANDARD CEMENT Co.			
E. THIELE:			
Dyckerhoff	2.90	@	3.25
UNITED STATES CEMENT Co.:			
Windsor	1.00	@	1.10
Standard			1.15
Cable's Portland	2.15	@	2.40
UNION AKRON CEMENT Co.:			
Akron "Star" brand.			

ASPHALT.

Prices range per ton	$15 00	@	20.00
According to quantity or brand, and whether taken from vessel or store.			

LIME.

Rockland common per bbl	1.00		
" finishing	1.20		
State, common	.90		
" finishing	1.10		
Kingston, ground	0.95		
Add 25c. to above figures for yard rates.			

STONE.

Cargo rates at New York.

Amherst freestone, No. 1 per cub. ft.	0.90	@	95
" " No. 2 "	0.75	@	0.80
" " light drab "	0.80	@	0.95
Berlin " in rough "	0.75	@	1.00
Berea " " "	0.75	@	1.00
Brownstone, Portland, Ct. "	1.00	@	1.30
" Belleville, N. J. "	0.75	@	1.25
Granite, rough	0.60	@	1.25
Common building stone per load	2.00	@	3.00
Base stone, from 2½ to 6 ft. lengths, per lin. ft.	0.40	@	3.00

SLATE.

Purple roofing per square	6.00	@	7.00
Green "	6.00	@	7.00
Red "	15.00		
Black Penna. (at New York) "	4.50	@	5.00

LUMBER.

Prices for yard delivery in New York.

PINE, Common box per M.	18.00	@	20.0
Choice "	55.00	@	80.
Tally plank, 1¼ in. 10 in. dres'd. each.	.44	@	.50
Tally boards, dressed com. "	.28	@	.30
SPRUCE, Boards dressed "	.25	@	.28
Plank, 1¼ in "	.28	@	.30
" 2 in. "	.38	@	.40
" 2 in. dressed "	.43	@	.45
Timber per M.	20.00	@	22.00
HEMLOCK, Boards each.	.18	@	.20
Joist, 2¾ × 4 to 4 × 6 in	.17	@	.44
OAK per M.	55.00	@	65.00
CYPRESS 1, 1¼, 2 and 2½ in "	35.00	@	40.00
YELLOW PINE, Girders "	25.00	@	30.00
Dressed flooring "	28.00	@	35.00
SHINGLES, Extra shaved pine, 16in. "			
" sawed 18 in. "	5.75	@	6.00
LATH, Cargo rate "	2.10	@	2.25

PAINT.

Lead, white, American dry per lb	.04¾	@	.05
" in oil pure "	.05¼	@	.06
English, B. B. in oil	.08¼	@	.08¾
Red, American	.05¼	@	.05¾
Litharge "	.05	@	.05¼
Venetian red, American "	.01	@	.01¼
Indian red "	.05	@	.10
Vermillion, American lead "	.11	@	.11¼
Paris green "	.15	@	.19
Umber, Amer. raw and powdered per lb.	.01¼	@	.01½
Drop black, Amer. "	.08	@	.12
" " "	.09	@	.11½
Chrome green	.05	@	.15
Oxide zinc, American	.03¾	@	.04
" French	.06¾	@	.06¾